Zootaxa 4093 (1): 001–025
http://www.mapress.com/j/zt/

Article

ISSN 1175-5326 (print edition)
ZOOTAXA
ISSN 1175-5334 (online edition)

http://doi.org/10.11646/zootaxa.4093.1.1
http://zoobank.org/urn:lsid:zoobank.org:pub:8C32F03F-E901-465D-B03D-7E6EEF288329

An inconspicuous, conspicuous new species of Asian pipesnake, genus *Cylindrophis* (Reptilia: Squamata: Cylindrophiidae), from the south coast of Jawa Tengah, Java, Indonesia, and an overview of the tangled taxonomic history of *C. ruffus* (Laurenti, 1768)

MAX KIECKBUSCH[1,4,§], SVEN MECKE[1,§], LUKAS HARTMANN[1], LISA EHRMANTRAUT[1], MARK O'SHEA[2] & HINRICH KAISER[3]

[1]*Department of Animal Evolution and Systematics and Zoological Collection Marburg, Faculty of Biology, Philipps-Universität Marburg, Karl-von-Frisch-Straße 8, 35032 Marburg, Germany*
[2]*Faculty of Sciences and Engineering, University of Wolverhampton, Wulfruna Street, Wolverhampton, WV1 1LY, United Kingdom; and West Midland Safari Park, Bewdley, Worcestershire DY12 1LF, United Kingdom*
[3]*Department of Biology, Victor Valley College, 18422 Bear Valley Road, Victorville, California 92395, USA; and Department of Vertebrate Zoology, National Museum of Natural History, Smithsonian Institution, Washington, DC 20013, USA*
[4]*Corresponding author. E-mail: kieckbus@students.uni-marburg.de*
[§]*Co-first authors, listed in alphabetical order*

Abstract

We describe a new species of *Cylindrophis* currently known only from Grabag, Purworejo Regency, Jawa Tengah Province (Central Java), Java, Indonesia. *Cylindrophis subocularis* **sp. nov.** can be distinguished from all congeners by the presence of a single, eponymous subocular scale between the 3rd and 4th or 4th and 5th supralabial, preventing contact between the 4th or 5th supralabial and the orbit, and by having the prefrontal in narrow contact with or separated from the orbit. We preface our description with a detailed account of the tangled taxonomic history of the similar and putatively wide-ranging species *C. ruffus*, which leads us to (1) remove the name *Scytale scheuchzeri* from the synonymy of *C. ruffus*, (2) list the taxon *C. rufa* var. *javanica* as *species inquirenda*, and (3) synonymize *C. mirzae* with *C. ruffus*. We provide additional evidence to confirm that the type locality of *C. ruffus* is Java. *Cylindrophis subocularis* **sp. nov.** is the second species of Asian pipesnake from Java.

Key words: *Cylindrophis subocularis* **sp. nov.**, *C. ruffus*, Serpentes, Cylindrophiidae, Asian pipesnakes, species complex, morphology, Central Java, Indonesia, Greater Sunda Islands

Zusammenfassung

Wir beschreiben eine neue Art der Gattung *Cylindrophis*, die gegenwärtig nur aus Grabag, Purworejo, Jawa Tengah (Zentral-Java), Java, Indonesien, bekannt ist. *Cylindrophis subocularis* **sp. nov.** unterscheidet sich von allen anderen Arten dieser Gattung durch das Vorhandensein einer einzelnen, namensgebenden Subokular-Schuppe, die sich zwischen das dritte und vierte oder das vierte und fünfte Supralabial-Schild schiebt, und den Kontakt zwischen dem vierten oder fünften Supralabiale und dem Auge verhindert. Zudem steht das Präfrontale in minimalem Kontakt mit dem Auge oder ist von diesem separiert. Wir stellen unserer Beschreibung einen detaillierten Überblick über die verworrene Taxonomie-Geschichte der ähnlichen und scheinbar weit verbreiteten Art *C. ruffus* voran, was uns dazu veranlasst (1) den Namen *Scytale scheuchzeri* aus der Synonymie von *C. ruffus* herauszunehmen, (2) *C. rufa* var. *javanica* als *species inquirenda* zu betrachten, und (3) *C. mirzae* mit *C. ruffus* zu synonymisieren. Wir liefern weitere Hinweise für die Berichtigung der Typuslokalität von *C. ruffus* auf Java. Bei *Cylindrophis subocularis* **sp. nov.** handelt es sich um die zweite auf Java vorkommende Asiatische Walzenschlange.

Schlüsselwörter: *Cylindrophis subocularis* **sp. nov.**, *C. ruffus*, Serpentes, Cylindrophiidae, Asiatische Walzenschlangen, Art-Komplex, Morphologie, Zentral-Java, Indonesien, Große Sundainseln

Accepted by Z. Nagy: 12 Jan. 2016; published: 21 Mar. 2016

Introduction

The genus *Cylindrophis*. The henophidian snake genus *Cylindrophis* Wagler, 1828 currently comprises 13 secretive, semifossorial species, including *C. aruensis* Boulenger, 1920; *C. boulengeri* Roux, 1911; *C. burmanus* Smith, 1943; *C. engkariensis* Stuebing, 1994; *C. isolepis* Boulenger, 1896; *C. jodiae* Amarasinghe *et al*., 2015; *C. lineatus* Blanford, 1881; *C. maculatus* (Linnæus, 1758); *C. melanotus* Wagler, 1828; *C. mirzae* Amarasinghe *et al*., 2015; *C. opisthorhodus* Boulenger, 1897; *C. ruffus* (Laurenti, 1768); and *C. yamdena* Smith & Sidik, 1998 (see Wallach *et al*. 2014; Amarasinghe *et al*. 2015). These snakes are collectively referred to as Asian pipesnakes due to their cylindrical appearance, with a body of near-uniform diameter. Members of the genus are small- to medium-sized (total length 125–857 mm), rather stout-bodied snakes that may be defined on the basis of the following eidonomic characters: (1) a relatively blunt head with minute eyes, head not distinct from neck, bearing a mental groove; (2) absence of true gastrosteges, with ventral scales only slightly larger than or equal in size to dorsal scales; (3) presence of a pair of pelvic spurs (= cloacal spurs) in both sexes; (4) a very short tail, often with conspicuous ventral coloration; and (5) contrasting light and dark ventral blotching (e.g., de Rooij 1917; Smith 1943; Taylor 1965; Greene 1973; pers. obs.). The conspicuous ventral color pattern plays a vital role in the defensive behavior of *Cylindrophis* species. When threatened, pipesnakes will flatten the posterior portion of their body and arch it above the ground to display their ventral pattern, while the head remains concealed among the body coils (e.g., Flower 1899; Barbour 1912; Smith 1927, 1943; Campden-Main 1970; Deuve 1970; Greene 1973).

Distribution. *Cylindrophis* is a widely distributed genus (Flower 1899; de Rooij 1917; Smith 1943; Lal Hora & Jayaram 1949; Taylor 1965; Campden-Main 1970; Deuve 1970; McDowell 1975; in den Bosch 1985; Stuebing 1991; Adler *et al*. 1992; Iskandar 1998; Zug *et al*. 1998; McDiarmid *et al*. 1999; Orlov *et al*. 2000; de Lang 2011) with species occurring from Sri Lanka (one species) throughout the continental and insular parts of Southeast Asia (12 species currently recognized). In Southeast Asia the genus is distributed from southern China and Hong Kong through Vietnam, Laos, Cambodia, Thailand, Myanmar, Peninsular Malaysia, and Singapore including Singapore, south to the Greater Sunda Islands (Borneo, Sumatra, Java, as well as some of their offshore islands), Sulawesi, the Lesser Sunda Islands (Lombok, Komodo, Flores, Sumbawa, Timor), and east to the Maluku Islands (Halmahera, Wetar, Damar, Babar, and into the Tanimbar Archipelago); the eastern distributional limit, the Aru Islands, was considered questionable by Iskandar (1998). However, within this vast range, smaller-scale zoogeographic patterns, phylogenetic relationships, and even the true species richness of the genus remain poorly known.

Many species of *Cylindrophis*, especially those from the eastern end of the distribution (e.g., *C. aruensis*, *C. boulengeri*, *C. isolepis*, *C. yamdena*), are known from very few specimens (McDowell 1975; Iskandar 1998; Smith & Sidik 1998). This is likely due to both the remoteness of the eastern Indonesian islands and the secretive lifestyle of these snakes, and *Cylindrophis* diversity in this region may still be underestimated. Even on Borneo, an island with a relatively well-studied herpetofauna (Das 2004), Stuebing (1994) discovered *C. engkariensis*, a species with a potentially very restricted range. More recently, Amarasinghe *et al*. (2015) described two new species (one from Singapore and one from Vietnam) that had been masquerading under the name *C. ruffus*. However, the descriptions and redescriptions (including of *C. ruffus*) presented by these authors contain some inaccuracies, including descriptive errors, which unfortunately increase the complexity of an already intricate taxonomic situation.

The problematic nature of *Cylindrophis ruffus*. Compared with other members of the genus, the species *Cylindrophis ruffus sensu historico* (e.g., Schlegel 1837b, 1837−1844; de Rooij 1917; Smith 1943; for a definition of the term *sensu historico* see below) exhibits an extraordinarily wide distribution, extending from mainland Southeast Asia across most parts of the Greater Sunda Islands into eastern Java (de Rooij 1917; Smith 1943; Taylor 1965; McDiarmid *et al*. 1999; Wallach *et al*. 2014). It was already identified as a species complex (Smith & Sidik 1998) and it appears to include several undescribed taxa (Amarasinghe *et al*. 2015; Mecke *et al*., in prep.). Despite its redescription by Amarasinghe *et al*. (2015), both the morphological definition and the geographic range limits of *C. ruffus sensu stricto* remain unsettled. *Cylindrophis ruffus sensu historico* appears to be common, frequently encountered (Smith 1943; Taylor 1965; Campden-Main 1970; Kupfer *et al*. 2003), and well represented in museum collections, but a comprehensive taxonomic revision of this group has never been conducted. While it is evident that the taxonomy of *C. ruffus* is flawed, its complex taxonomic history, the absence of a type specimen, and an incorrect type locality ("Surinami") have stood in the way of developing a stable taxonomic hypothesis (Boie 1827; Schlegel 1837a, b; McDiarmid *et al*. 1999; Wallach *et al*. 2014). Furthermore, due to the age of available museum specimens in general, and of type material in particular, it is only through a thorough morphological study encompassing the entire range and variation of *C. ruffus* that its taxonomy can be resolved.

History necessitates three working definitions of *Cylindrophis ruffus*. As part of our comprehensive review of the genus *Cylindrophis*, we examined several hundred museum specimens listed by the available collection data as *C. ruffus*. We noted that, given the long history of *C. ruffus* in the literature and the morphological diversity of examined specimens, three definitions of *C. ruffus* as a taxonomic unit became necessary to permit a complete understanding of how different authors through time dealt with the taxon. Our most inclusive definition for the taxon is '*C. ruffus sensu historico*[1],' which includes all forms historically considered to be part of *C. ruffus* at one time or another, but before the revision of Amarasinghe *et al*. (2015). This definition includes *C. burmanus* as well as the forms that were recently described as *C. jodiae* and *C. mirzae* by Amarasinghe *et al*. (2015); it essentially covers forms from all over Southeast Asia and into the Indonesian archipelago. The second, more specific definition is '*C. ruffus sensu lato*,' which excludes *C. burmanus* and *C. jodiae*, but still includes the weakly defined *C. mirzae* as well as populations from Borneo, Java, Sumatra, and Peninsular Malaysia. Specimens north of Peninsular Malaysia belong either to *C. burmanus* or *C. jodiae* (pers. obs.). Our third definition is '*C. ruffus sensu stricto*,' by which we refer to the true species *C. ruffus*.

An unusual population from Java. As we progressed with our study, we noticed that a particular specimen series was sufficiently different from *C. ruffus sensu historico* to warrant recognition as a distinct species, even while our review of *C. ruffus* was still in progress. Specifically, our work in the collections at the Naturalis Biodiversity Center in Leiden, the Netherlands (formerly the Rijksmuseum van Natuurlijke Historie; RMNH), the Natural History Museum in Vienna, Austria (NMW), and the Museum für Naturkunde Berlin, Germany (ZMB), revealed several specimens labeled as *C. ruffus* that had apparently been collected at a single, isolated locality on the Indonesian island of Java, and which allowed easy differentiation from all other forms of *Cylindrophis* by a unique character: the presence of a subocular scale. We here describe this species, which is currently only known from Grabag, Purworejo Regency, Jawa Tengah Province (Central Java), Indonesia, and provide an historical overview of *C. ruffus* taxonomy.

Material and methods

Morphological characters. For each specimen of the new species (n = 8) and all specimens used for comparison (n = 451), we recorded data for 52 morphological characters. Of these, 37 were metric, eight meristic, and seven qualitative. In the list below, character names are provided in bold, followed by their definitions.

The following metric characters were obtained (characters used for the calculation of ratios are abbreviated for convenience): **snout-vent length** (SVL), measured from tip of snout to cloaca; **tail length** (TL), measured from cloaca to tip of tail; **body diameter** (BD), calculated as the mean of body height and body width at midbody; **head length** (HL), measured from tip of snout to articulation of quadrate bone; **head width** (HW), measured at level of anterior margin of parietals; **snout length** (SL), measured from tip of rostral to anterior margin of orbit; **snout width** (SW), measured at level of nares; **eye diameter** (ED), measured as length of orbit; **interorbital distance** (IOD), measured as shortest distance between orbits across head; **naso-orbital distance** (NOD), measured from posterior margin of naris to anterior margin of orbit; **internarial distance**, measured between interior margins of nares; **length of prefrontal-eye contact** (PrefO), measured at prefrontal margin bordering orbit. We also measured the following **head scale characters** (dimensions of these scale characters are expressed as the maximal length, height, or width): rostral height and width; nasal length and height; prefrontal length and width; frontal length and width; parietal length and width; supraocular length and width; postocular length and height; anterior temporal length and height; upper posterior temporal length and height; mental height and width; anterior chin shield length and width; posterior chin shield length and width; and mental groove length. SVL and TL were measured to the nearest 1 mm by gently straightening the respective specimen along a metric ruler. All other metric characters were measured to the nearest 0.1 mm under a stereomicroscope using digital calipers and a measuring magnifier. We also calculated the following ratios: TL/SVL, BD/SVL, HL/SVL, HW/HL, SL/HL, SW/SL, ED/HL, IOD/HL, NOD/HL, and PrefO/ED.

1. The term *sensu historico* has been used by scholars in the classical sciences (specifically of the languages of Ancient Greece and Ancient Rome) to indicate that a term is used within an historical context, as opposed to a direct translation. We borrow this term to distinguish between a taxon as historically defined and one based on the most current taxonomy.

The following meristic characters were counted: number of **dorsal scale rows**, counted in an inverse 'V' shape (to include all dorsal scales developmentally associated with a single pair of ribs) at (A) one head length behind head, (B) at midbody, and (C) one head length before cloaca (displayed in a formula as A/B/C); **ventrals**, beginning with the gular scale bordered by posterior chin shields; **subcaudals**, counted from cloaca to end of tail, excluding terminal spine (this count included, if present, a single row of multiple small scales bordering cloaca, counted as one subcaudal); **postoculars**; **temporals**, including (a) number of anterior temporals and (b) number of posterior temporals, expressed in a formula as a + b; number of **supralabials**; number of **infralabials**; and **number of light transverse ventral blotches** present along body, beginning with first blotch behind head to last blotch anterior to cloaca. Head scales occurring bilaterally were counted on (a) the right and (b) the left side of the body. We use the formula a|b when counts are different on either side of the body; a single value for a bilaterally occurring head scale character indicates that counts on both sides of the body resulted in an identical value.

The system of counting ventral scales described by Dowling (1951) is not applicable to anilioid snakes (Aniliidae, Anomochilidae, Cylindrophiidae, Uropeltidae) because these, unlike more advanced snakes, have no true gastrosteges and no preventral scales. Gower & Ablett (2006) therefore proposed a ventral-counting system for these snakes that includes every scale between the mental and cloacal scute. We did not apply their system, because all members of the genus *Cylindrophis* possess a mental groove formed by the first pair of infralabials and two pairs of enlarged chin shields, with the latter morphologically distinct from the smaller scales bordering them posteriorly. Consequently, ventral scales were counted from the first unpaired scale positioned medially behind the mental groove to the, often slightly enlarged, scale anterior to the divided cloacal scute.

In terms of qualitative characteristics, we recorded the specific **supralabials contacting the orbit**; the specific **infralabials contacting the chin shields**; the **condition of the cloacal scute** (divided or entire); and **pattern and coloration** of head, dorsum, venter, and tail. For descriptions of pattern and coloration we applied the terminology of Köhler (2012). Numbers in parentheses behind the respective capitalized color name refer to the coding therein. Sex was determined by the presence of testes or ovaries and oviducts and only if ventral incisions into the body cavity already existed.

Comparative material. Comparative morphological data were obtained primarily from museum specimens examined by the authors. Only for comparisons with *Cylindrophis aruensis* and *C. yamdena* did we use data from the original species descriptions or other relevant literature.

We compared the new species to 451 specimens from across the range of *Cylindrophis*, housed in the following collections (abbreviations follow Sabaj Pérez [2014]): AMNH, MHNG, MTD (= MTKD), NMB, NMBE, NMW, RMNH, SMF, ZMA (now in Naturalis, Leiden; RMNH), ZMB, ZMH, and ZRC. Since the examined material used for species delineation included (1) very distinct species not easily confused with the new species, and (2) 231 specimens of *C. ruffus sensu lato*, our Appendix includes only a relevant subsample of museum specimens used for direct comparisons herein, most notably specimens of *C. ruffus sensu lato* from Java, including 53 specimens with precise localities (e.g., towns, regencies) and 60 lacking exact locality data (specimens labelled only as collected on 'Java'). Although *C. mirzae* might ultimately be considered a valid species, we herein refrain from differentiating between *C. mirzae* and *C. ruffus* for reasons outlined in the taxonomic history section.

Statistical analyses. Since our new species is sufficiently distinct from congeneric taxa by a multitude of characters (see Results: Comparisons), and with a revision of *C. ruffus* in progress, our statistical analyses for this study focused exclusively on revealing characters to distinguish between the new species and *C. ruffus* from Java (the type locality of *C. ruffus*; see Results: History leads to the type locality of *Cylindrophis ruffus*). Meristic characters that were constant between the groups or exhibited two expressions only were excluded from all statistical analyses.

For statistical tests, the data analysis software R (R-Core Team, version 3.1.3) was used. The normality assumption for individual variables (i.e., of the metric and meristic characters, and ratios defined above) was tested with a Shapiro-Wilk statistic. Prior to variance analyses (see below), tested metric variables were adjusted to the mean SVL across all groups, in order to minimize variance due to possible ontogenetic variation between different populations (e.g., Thorpe 1975, 1983; Turan 1999; Vogel *et al.* 2007; van Rooijen & Vogel 2008, 2010, Mecke *et al*. 2013). The equation for the adjustment of data follows Vogel *et al*. (2007), van Rooijen & Vogel (2008, 2010), and Mecke *et al*. (2013):

$$Y_{adj} = Y_i - ß * (SVL_i - SVL_{mean})$$

In this formula, Y_{adj} is the value of the respective, allometrically adjusted variable of the i^{th} specimen, Y_i is the original value of this variable of the i^{th} specimen, β is the pooled regression coefficient of Y against SVL, SVL_i is the SVL of the i^{th} specimen, and SVL_{mean} is the overall mean SVL of all specimens.

Subsequently, adjusted metric characters, meristic characters, and ratios were tested for statistically significant differences between the two *Cylindrophis* forms occurring on Java (our new species and *C. ruffus sensu lato*). We used one-way ANOVA (analysis of variance) if a variable fulfilled normal distribution, and a Mann-Whitney U-test if a variable was not normally distributed. When the respective statistical test yielded significant outputs (i.e., statistically confirming differences between the two compared forms), these are shown in the Results section with superscripted asterisks indicating probability levels as follows: * < 0.05; ** < 0.01; *** < 0.001.

Results

Comments on the taxonomic history of *Cylindrophis ruffus* (Laurenti, 1768)

Early beginnings: Johann Jakob Scheuchzer's (1672–1733) *Physica Sacra Illustrata*. Scheuchzer (1735) was probably the first author who, in his pre-Linnæan treatise entitled *Physica Sacra Illustrata*, depicted snake specimens referable to *Cylindrophis ruffus sensu historico*, presenting three different illustrations (Tabulae DCXXIX-F, DCLX-3, DCCXLVIII-6; illustrated in Fig. 1A–C herein) of specimens from the Linck collection (Merrem 1820; Boie 1827; Wagler 1828–1833; see also Bauer & Wahlgren [2013] for an overview of the Linck collection). A precise identification of the specimens depicted, including their allocation to *C. ruffus*, *C. burmanus*, or *C. jodiae*, however, is difficult.

Albertus Seba (1665–1736) and his Cabinet of Natural Curiosities. In the second volume of his *Thesaurus*, Seba (1735: Tabulae VII-3, XXV-1; illustrated in Fig. 1D–E herein), described and figured two snakes based on specimens housed in his cabinet of natural curiosities. These were identified as the taxon *Cylindrophis ruffus* by subsequent authors (e.g., Merrem 1820). Seba's short diagnosis indicates that both snakes originated on Ambon, an island in the Moluccas. However, in the main description (following the diagnosis) and referring to Tabula XXV-1 (illustrated in Fig. 1E herein), Seba (1735: 26) assigned a larger area of distribution to the respective specimen, namely "Les Grandes & […] les Petites Indes" [i.e., Asia and the American Continents]. Since the figures in Seba leave little doubt as to the identity of the specimens (*C. ruffus sensu historico*), it is evident that they must have originated in Asia. The taxon, however, does not appear to occur on Ambon (de Lang 2013), an island with a five-centuries-long history of commercial and strategic importance for Europe, with specimens both collected or merely shipped from there (e.g., Weijola & Sweet 2015).

Laurens Theodorus Gronovius (1730–1777) and the first detailed account of *Cylindrophis ruffus*. In his *Musei Ichthylogici*, a detailed, descriptive catalogue of fish, amphibian, and reptile specimens housed in his Leiden cabinet of curiosities, Gronovius (1756) introduced under the heading "6. ANGUIS squamis abdominalibus CLXXIX, & squamis caudalibus VII" [6. SNAKE with 179 ventral scales and seven subcaudal scales] a taxon that Merrem (1820) listed as *Tortrix rufa* (= *Cylindrophis ruffus*). Gronovius's fairly detailed description of his species "6. ANGUIS" (Gronovius 1756: 54; see also Adler *et al*. 1992) matches *C. ruffus sensu historico*, based on the following morphological characters: 179 ventrals; seven subcaudals; small eyes; ventrals slightly enlarged, hexagonal; stout, short, conical tail; reddish coloration with white transverse ventral bands. Although Gronovius stated that his specimen originated in "Surinamam" [sic] [= Suriname], a thorough literature survey revealed that there is no snake taxon known from Suriname (nor a species from outside Asia) that would match his description. The only Asian species matching the listed characteristics are *C. ruffus sensu lato* and *C. jodiae*, and we therefore conclude that Gronovius's specimen must have been collected in Asia.

Josephus Nicolaus Laurenti (1735–1805) and the species description of *Cylindrophis ruffus*. The valid species name *ruffa* was coined by post-Linnæan author Laurenti in 1768, who placed this taxon from a location he listed as "Surinami" (Laurenti 1768: 71) into the genus *Anguis* Linnæus, 1758. As was common practice during

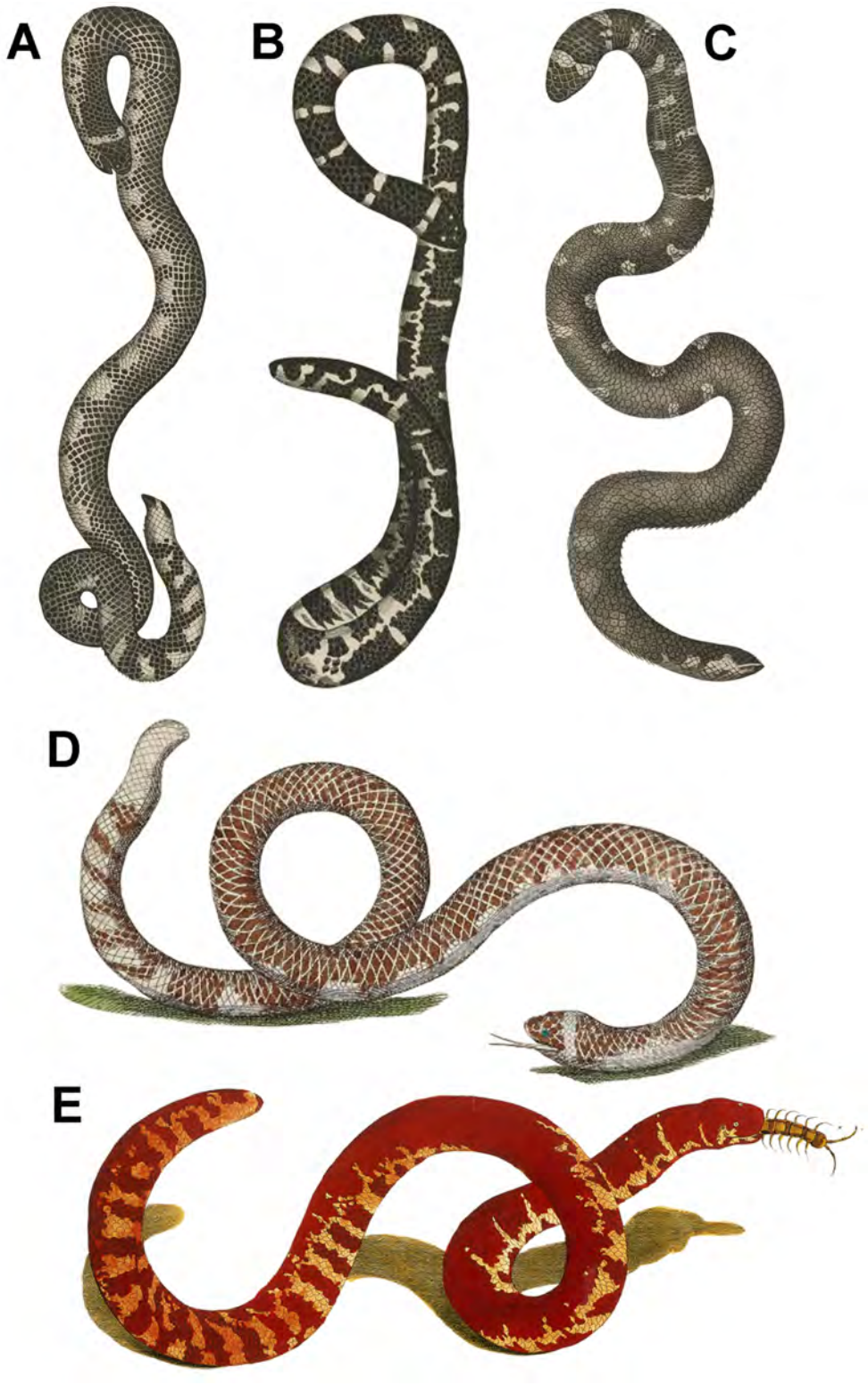

FIGURE 1. Historical drawings of *Cylindrophis ruffus sensu historico*. Illustrations from: (A–C) Scheuchzer (1735); and (D–E) Seba (1735). Illustrations are not to scale. Plate prepared by Hinrich Kaiser and Mark O'Shea.

that time, Laurenti only provided exceedingly short descriptions of the known amphibian and reptile species that, taken on their own, would hardly permit a proper diagnosis of specific taxa. However, in the case of his taxon *Anguis ruffa*, Laurenti (1768: 139) stated "*hospitatur in Museo Gronoviano*" [housed in the collection of Gronovius], thereby apparently referring to Gronovius's 1756 catalogue (and hence to *Anguis* species number 6). A

comparison of Gronovius's and Laurenti's texts shows that Laurenti's description is, by virtue of its wording, a shortened version of that provided by Gronovius, with both authors providing the same erroneous information regarding the specimen's provenance. This leaves little doubt that the species identity of Laurenti's *A. ruffa* is the same as *Anguis* species number 6 of Gronovius (1756). It is unfortunate that the type specimen of *A. ruffa* appears to be lost (Iskandar & Colijn 2002). Gronovius's private collection was partly incorporated into the collection at the BMNH (e.g., dried fish-skins; Gray 1854), but the rest of his collection probably became dispersed. His herpetological collection cannot be traced to any larger museum collection extant today (Aaron M. Bauer, in litt.).

Johann Friedrich Gmelin (1748–1804) and his new species name. In his enhanced edition of the Linnæan *Systema Naturae*, Gmelin (1789) listed *Anguis rufus* (*nomen emendatum*) and attributed this taxon to Laurenti (1768). Gmelin (1789) also coined a new species name, *A. striatus*, and attributed this species to the pre-Linnæan Gronovius by referencing the publication of the latter, directly referring to *Anguis* species number 6 ("A. *Gron. mus*. 2. *p*. 53. *n*. 6."). Since Laurenti (1768) clearly refers to Gronovius (1756) in his description of *A. ruffa* as well, the connection between the descriptions published by Gmelin (1789), Laurenti (1768), and Gronovius (1756) leaves little doubt, that *A. striatus* can be regarded as an objective junior synonym of *Cylindrophis ruffus*. Daudin (1803) also listed Gmelin's accounts of *A. striatus* and *A. rufus*, and Gronovius's description of *Anguis* species number 6 in his references for his description of *Eryx rufus* (*comb. nov.* for *Anguis ruffa* Laurenti, 1768).

Contributions by Patrick Russell (1726–1805). Russell (1801) used the preoccupied name *Anguis scytale* Linnæus, 1758 (current name *Anilius scytale*) to refer to a *Cylindrophis ruffus* specimen he received from Java (Russell 1801: Plate XXVII; illustrated in Fig. 2A herein). Hence, *Anguis scytale* Russell, 1801 is a junior homonym of *Anilius scytale* (Linnæus, 1758) and a subjective junior synonym of *C. ruffus* (Laurenti, 1768).

George Shaw (1751–1813) and the confusion over *Anguis scytale*. Shaw (1802) depicted a *Cylindrophis ruffus* specimen as part of his description of *Anguis Corallina*, using a figure (Shaw 1802: Fig. 131; illustrated in Fig. 2B herein) undoubtedly based on Seba (1735: Tabula XXV-1; see Fig. 1E herein). In his references prefacing the description of *A. Corallina*, Shaw listed Gmelin (1789), although in his own account of *A. corallinus* (*nomen emendatum*) Gmelin referenced Laurenti (1768) as his source for that name. Laurenti (1768), Gmelin (1789), and Shaw (1802) list the same plate in Seba (1735: Tabula LXXIII-2) as a reference. Alas, the specimen in this Tabula is not a *Cylindrophis* at all, but an individual of *Anilius scytale* (a South American species), and hence, Laurenti's *Anguis corallina* and Gmelin's *A. corallinus* have been regarded as synonyms of *Anilius scytale* (e.g., Wallach *et al*. 2014). We agree and therefore do not follow Boulenger (1893) in regarding Shaw's *Anguis Corallina* as synonymous with *C. rufus* (*nomen emendatum*). We believe that the *C. ruffus* figure in Shaw (1802), the sole indication supporting synonymy of *C. ruffus* with *A. Corallina*, was used by mistake; it does not correspond to Seba's Tabula LXXIII-2.

Blasius Merrem (1761–1824) and the problem with *Scytale scheuchzeri*. In his *Versuch eines Systems der Amphibien*, Merrem (1820) listed *Tortrix rufa* (*nomen emendatum*) and described a new species, *Scytale scheuchzeri*. As part of this description, Merrem referred to an illustration in Scheuchzer (1735: Tabula 647-1; illustrated in Fig. 2C herein). The name *S. scheuchzeri* was considered synonymous with *Cylindrophis ruffus* by subsequent authors (e.g., Boie 1827; Schlegel 1837b; Duméril & Bibron 1844; Gray 1849; McDiarmid *et al*. 1999; Bauer & Wahlgren 2013; Wallach *et al*. 2014). However, it is evident from both Scheuchzer's illustration and Merrem's description of his genus *Scytale* (non *Scytale* Latreille in Sonnini and Latreille, 1802) that *S. scheuchzeri* is not conspecific with *C. ruffus*. Despite similarities in coloration, the specimen depicted by Scheuchzer has enlarged gastrosteges and a tapering tail. Merrem (1820) also listed enlarged gastrosteges in his generic description of *Scytale*. Hence, the name *S. scheuchzeri* does not refer to an anilioid snake but most likely to a colubroid snake, and we therefore remove this name from the synonymy of *C. ruffus*.

Contributions by Friedrich Boie (1789–1870) and Hermann Schlegel (1804–1884). Boie (1827) was the first author to correct the distribution of *Cylindrophis ruffus* (under the name *Tortrix rufa*) to Java (not Schlegel 1837a, b, as commonly believed[2]; see e.g., Wallach *et al*. 2014). Schlegel (1837a: 128) then revised the distribution of *C. ruffus* (as *T. rufa*) to "*Java et de Célèbes*" [Java and Sulawesi], but already indicated that the Sulawesi form was distinct, later (1837b: 11) referring to it as *Tortrix melanota* (= *C. melanotus*; see also Wallach *et al*. 2014). Schlegel (1837b) provided distribution records for the genus *Cylindrophis* (as *Tortrix*) from

2. Both Amarasinghe *et al*. (2015) and Uetz & Hošek (2015) list Schlegel (1844) as the reference for the type locality correction for *C. ruffus* to Java. However, Schlegel (correctly cited as 1837−1844), in the explanatory text supplementing the plates in his *Abbildungen Neuer oder Unvollständig Bekannter Amphibien*, does not provide such a correction (but see Schlegel 1837a, b).

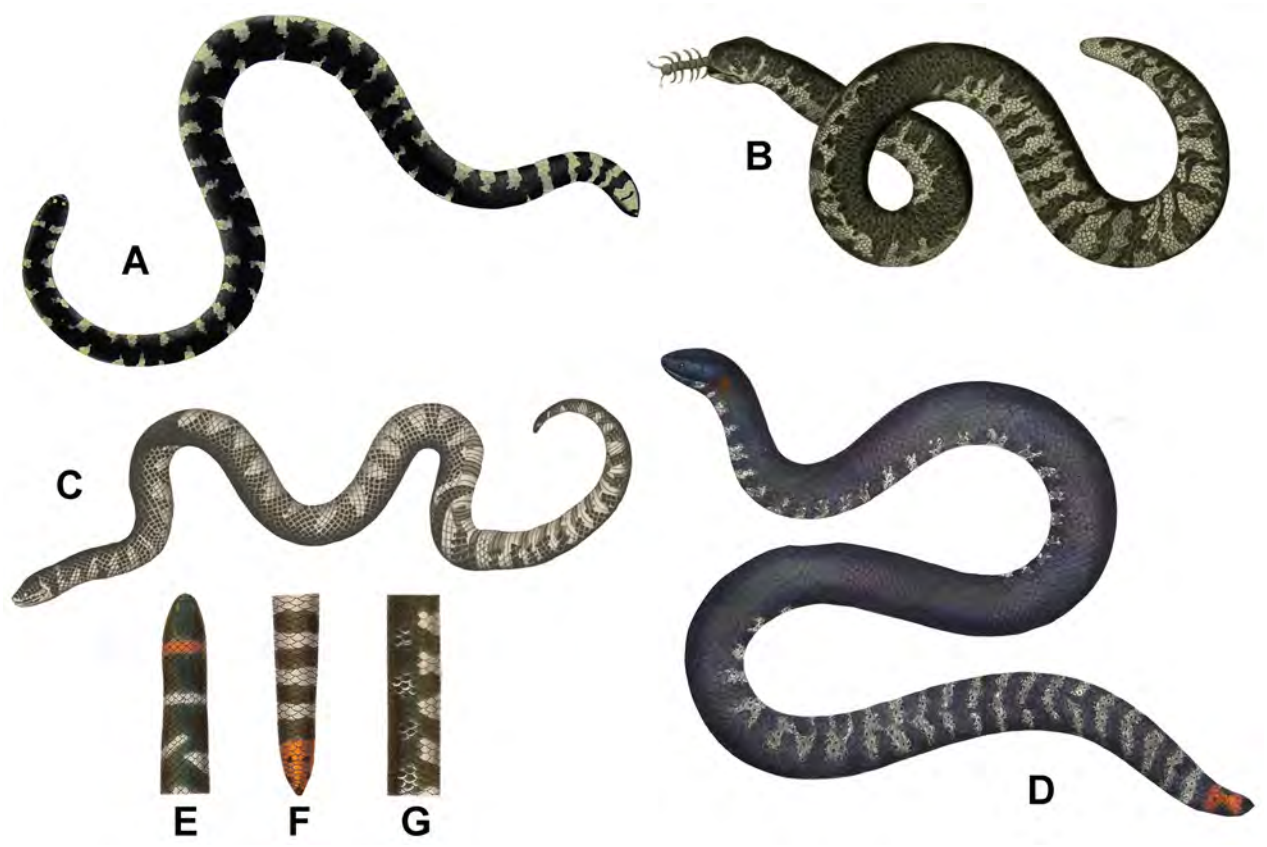

FIGURE 2. Historical drawings of *Cylindrophis ruffus sensu historico* (A, B & D–G) and *Scytale scheuchzeri* (C). Illustrations from: (A) Russell (1801); (B) Shaw (1802); (C) Scheuchzer (1735); (D) Wagler (1828–1833); and (E–G) Schlegel (1837–1844). Illustrations are not to scale. Plate prepared by Hinrich Kaiser and Mark O'Shea.

India: (1) "Tranquebar" (Tharangambadi, State of Tamil Nadu, SE India; see Russell 1801: 33), which was an important seaport during Russell's time; and (2) "Bengale" (NE India and Bangladesh). However, Smith (1943) indicated that the genus *Cylindrophis* did not occur on the Indian subcontinent, and hence the distributional records listed above appear to be in error and a reflection of maritime trade routes as opposed to natural distribution.

Johann Georg Wagler (1800–1832) and *Cylindrophis resplendens*. A new species from Java was described and figured by Wagler (1828–1833: Tabula V-1; illustrated in Fig. 2D herein) under the name *Cylindrophis resplendens* Wagler, 1828. Although Wagler (1828–1833) provided a figure of *C. resplendens* in life (see Fig. 2D herein), capably illustrated by Kaspar Georg Karl Reinwardt (1733–1854) (see also Schlegel 1837b), in the *Observationes* following the species description, he explicitly referenced Russell (1801) for additional illustrations of that taxon.

Cylindrophis resplendens, the type species of the genus *Cylindrophis* (Wallach *et al*. 2014), has since been synonymized with *C. ruffus* (e.g., Schlegel 1837b; Duméril & Bibron 1844; Gray 1849; Boulenger 1893; Smith 1943; McDowell 1975; McDiarmid *et al*. 1999; Wallach *et al*. 2014; Amarasinghe *et al*. 2015). Wagler's description of *C. resplendens* was based on specimens housed in the "*Museo Parisiensi*" [now MNHN], "*Lugdunensi Bat*." [now RMNH], and "*in collectione mea*" [in my collection; probably referring to the ZSM collection]. One or more type specimens may still exist in the collection of the MNHN, but we failed to locate specimens from the time of the original description matching Wagler's Tabula V-1 in the collections of either RMNH or ZSM.

John Edward Gray (1800–1875) and *Cylindrophis rufa* var. *javanica*, the name of a taxon from Borneo. Gray (1849: 112) described *Cylindrophis rufa* var. *javanica* in a simple two-line listing for a single specimen from Borneo (not from Java, as stated by Amarasinghe *et al*. 2015), donated by Sir James Brooke (1803–1868), the first

White Rajah of Sarawak. This specimen is still extant in the collection of the BMNH[3]. Gray (1849) referred to figures in Schlegel (1837–1844: Plate 33, Figs 5–10; illustrated in Fig. 2E–G herein), which according to Schlegel's own statement were drawn from a single Javanese specimen. However, Schlegel (1837–1844) also mentioned similarities between the Java "race" (Schlegel's term) and a specimen the RMNH received from Borneo. This may have led Gray, who was clearly familiar with Schlegel's works, to apply the geographically incongruous name *javanica* (referring to the island of Java) to a specimen from a locality on Borneo. Gray's taxon was synonymized with *C. ruffus* by Amarasinghe *et al*. (2015).

Malcom Arthur Smith (1875–1958) and a valid species from Myanmar. Smith (1943) described a subspecies of *Cylindrophis ruffus* from "Tenasserim and Burma as far North as Myitkyina" (today's Myanmar) as *C. rufus burmanus*. This taxon was accepted as a subspecies with the spelling *C. r. burmanicus* (*nomen emendatum*) by Lal Hora & Jaya Ram (1949), and in its original form by Taylor (1965). McDiarmid *et al*. (1999) and Wallach *et al*. (2014) included subspecies in their synonymy lists of species, but these lists allow no conclusion regarding the validity of the listed subspecies. Recently, Amarasinghe *et al*. (2015: 41) raised *C. r. burmanus* to species level (see also Iskandar & Colijn 2002) and provided a redescription of that species based on "the presumed type series." However, among the six paralectotypes designated by Amarasinghe *et al*. (2015) is one specimen (cited as ZMB 3094) that these authors considered to "probably" be a paralectotype, based on Iskandar & Colijn (2002). The ZMB accession number of this specimen actually identifies a neotropical frog (Frank Tillack, in litt.) and hence cannot possess "the same characters as the lectotype" (Amarasinghe *et al*. 2015: 41). Iskandar & Colijn (2002) stated that ZMB 3094 originated at "Bhamo," Myanmar. The only *Cylindrophis* specimen from Bhamo housed in the ZMB collection has the accession number ZMB 11619, and it was collected by Leonardo Fea (1852–1903) in the late 1880s. We doubt that this specimen could have belonged to the original type series used by Smith (1943) to define *C. r. burmanus*. We consider the designation of ZMB 3094 as a paralectotype of *C. burmanus* to be invalid.

Amarasinghe *et al*. (2015) also presented conflicting data on the shape of the collar of *Cylindrophis burmanus*. In their Table 2 (see also their Figs. 2 & 3), the band around the neck was listed as "dorsally interrupted" in that species, yet it was described as complete when referring to *C. burmanus* in their diagnoses of both *C. ruffus* ("a complete and narrow ring encircling the nape in *C. burmanus*," p. 38) and *C. burmanus* ("a complete and narrow ring encircling the nape," p. 41). As seen in the illustration of the *C. burmanus* lectotype (Amarasinghe *et al*. 2015: Fig. 3A), the band is actually separated by a single, dark brown vertebral scale. Our unpublished data show that this character is quite variable in both *C. burmanus* and Javanese *C. ruffus* and not useful to diagnose either taxon. Likewise, there is incongruity in the description of the pattern of dorsal blotches in *C. burmanus*. Whereas in their Table 2 Amarasinghe *et al*. (2015) indicated that *C. burmanus* had alternating dorsal blotches, they also stated that the species had paired (or "constant"; their term, p. 41) dorsal blotches. In a group of snakes where the true level of intra- and interspecific morphological variability has not been fully explored, such contradictions may lead to a similar level of instability as has resulted from the original descriptions (Laurenti 1768; Smith 1943).

History leads to the type locality of *Cylindrophis ruffus*. As a consequence of our careful review of the historical literature, we agree with Amarasinghe *et al*. (2015) that the type locality of *Cylindrophis ruffus sensu stricto* should be restricted to Java. The taxonomic history of the species shows that specimens in historical times were most often collected on Java (e.g., Russell 1801; Boie 1827; Wagler 1828–1833; Schlegel 1837–1844), which was an important trading hub for the Dutch Empire. With the establishment of the Dutch East India Company (in Dutch: Vereenigde Oostindische Compagnie, VOC) in Batavia (now Jakarta) in 1611, trade to Europe from Southeast Asia became heavily influenced by shipping conducted on behalf of the VOC (Boxer 1965). After the disbanding of the VOC in 1799, the various administrations of the Netherlands continued trading with their Southeast Asian colonies during the Napoleonic upheaval, although contacts with these colonies were often

3. In his published snake catalogue, Gray (1849) listed six specimens of *C. rufa*, three (*a*–*c*) from Penang (presented by General Hardwicke), one (*d*) from Borneo listed as "Var. 1. *Javanica*" (presented by Sir James Brooke), and two additional ones (*e*–*f*) listed as "Var. 2." without providing a Latin name. However, in the extant handwritten catalogue at the BMNH, the entry for the particular specimen from Borneo presented by Sir James Brooke, is found under the number IV.23.2.*a*, which is also how it is listed in the collection's online database. We have ascertained that the specimen identified in the collection by a jar label as IV.23.2.*a* ("Penang. Gen. Hardwicke") is unquestionably conspecific with *C. jodiae* and therefore cannot have originated on Borneo. Furthermore, the specimen in the jar labelled "IV.23.2.*d*. Borneo. Sir J. Brooke" possesses large blotches on the prefrontals, as mentioned in Gray's description. The error is therefore not in Gray's published snake catalogue, but appears to be an error that might have happened when the entries in Gray's catalogue were transferred to the extant BMNH catalogue. Thus, the holotype of *C. rufa* var. *javanica* really does have the number IV.23.2.*d*. It is not currently indicated as a type specimen in the BMNH collection.

blockaded by the British. Shortly after The Netherlands were annexed by France in 1810, the last Dutch colony in Southeast Asia, Java, fell to Britain in 1811. However, the Netherlands regained independence and became a kingdom in 1813, restoring their authority over the islands of Southeast Asia in 1816. The Dutch presence lasted until a protracted dispute with Indonesia in the 1960s[4], and trade continued throughout this time (e.g., Motadel 2014).

As highlighted above, the pipesnake specimen on which Laurenti (1768) based his description was housed in Gronovius's extensive natural history collection located in Leiden. Laurens Theodorus Gronovius and his father, Jan Frederik Gronovius (1686–1762), were both renowned naturalists who were tied into early global trade, and both would have received specimens from America and Asia via their trade connections (e.g., Margócsy 2014). Based on the historic and economic circumstances that place Java as the nexus of Dutch trade with Southeast Asia, along with the fact that Javanese *Cylindrophis* are the form most reliably described and illustrated in historical accounts, we regard the type locality restriction Java as conforming with Recommendation 76A.1.4 of the *International Code on Zoological Nomenclature* (ICZN 1999). For a neotype designation (Mecke *et al*., in prep.), we believe that the type locality should be further restricted to northwestern Java, where the main trade port was located at the time the original type specimen would have been collected (before 1756); most other parts of Java remained undeveloped during that time as indicated by historic maps (e.g., "Nouvelle Carte de l'Isle de Java" by Baussard 1756).

Amarasinghe *et al*. (2015) offered another hypothesis to demonstrate that the original type specimen originated in Java: the possible confusion between the town of Batavia, Saramacca District, Suriname, and Batavia (Jakarta), Java Island, Indonesia. While this is an interesting hypothesis, historical evidence appears to contradict this line of reasoning. Firstly, shipments of specimens to private collectors in Leiden from mid-18th century Suriname would have included only the name of the colony (i.e., Suriname) and possibly the main port (Paramaribo), but not the name of a strategically irrelevant, small settlement (Marinus Hoogmoed, in litt.). Secondly, the settlement in present-day Suriname near the confluence of the Coppename and Saramacca Rivers called Batavia was founded only in 1790 (Anonymous 2015), several decades after the specimens Laurenti described would have had to have reached Leiden in order to become integrated into Gronovius's collection. Thus, it appears that the problem with the type locality of *C. ruffus sensu stricto* really is a documentation error and not due to confusion with the geographic identity of a place.

Synonyms. Based on the careful survey of early literature accounts and descriptions, we have determined that the following names are synonyms of *Cylindrophis ruffus* (with type locality in Java): (1) *Anguis striatus* Gmelin, 1789 and, until evidence to the contrary becomes available, (2) *A. scytale* Russell, 1801, and (3) *C. resplendens* Wagler, 1828. Gray's (1849) *C. rufa* var. *javanica* should be regarded as *species inquirenda* until a formal revision of *C. ruffus* is conducted. Gray's name *javanica* would be available for the purposes of nomenclature for a *Cylindrophis* species from Borneo, and if combined with the masculine generic name would need to be emended to *javanicus*. Even though *C. engkariensis* and *C. lineatus* are Bornean taxa, they are clearly distinct from *C. ruffus* and from the *javanica* type specimen held at the BMNH (BMNH IV.23.2.*d*.) and therefore not impacted by the availability of the name *javanica*.

Comments on Amarasinghe *et al*. (2015). In their recent publication, Amarasinghe *et al*. (2015) redescribed *Cylindrophis ruffus* based on 14 specimens from Java. However, the characters used in their diagnosis do not allow either unequivocal species identification, nor are they suitable to establish stable species boundaries. Our unpublished data from 113 Javanese specimens indicate that *C. ruffus sensu lato* includes sympatric forms with specimens that (1) possess 19 or 21 dorsal scale rows at midbody, (2) show great variability in the number of ventrals (179−225), (3) have either a complete or interrupted collar, and (4) may or may not possess dorsal blotches that are, if present, either paired or alternating, and either complete or interrupted. We are currently in the process of determining the taxonomic status of Javanese *C. ruffus* populations (Mecke *et al*., in prep.) and to resolve which of these forms are conspecific with the specimen described by Gronovius (1756).

Amarasinghe *et al*. (2015) also described two new species of *Cylindrophis*, *C. jodiae* and *C. mirzae*. This publication exists in two versions, an earlier one, in which Fig. 8 lists the names of the new species as *C. jodii* and *C. mirzai*, and a revised version in which these errors have been corrected. These versions are otherwise

4. Indonesia gained independence in 1949 after a period of Japanese occupation during World War II (1942–45), but Dutch New Guinea did not become part of Indonesia until international pressure and Indonesian military infiltration forced the Netherlands to relinquish control in 1962 (Gruss 2005).

indistinguishable, and it appears that the revised version was simply exchanged on the journal's website for the one with the errors. This is evident from the URL[5] used to download the revised file. However, having been validly published in the first version of the paper, the names *C. jodii* and *C. mirzai* must be considered objective junior synonyms of *C. jodiae* and *C. mirzae*, respectively.

While the pholidotic characters of *Cylindrophis jodiae*, a species widely distributed on mainland Southeast Asia (pers. obs.), conform to our unpublished data, qualitative color characters vary both intraspecifically and ontogenetically (Kieckbusch *et al*., unpublished data). The definition of *C. mirzae*, on the other hand, appears to be problematic. One of the key characteristics listed by Amarasinghe *et al*. (2015: Table 3) to differentiate *C. mirzae* from *C. ruffus* was an invariable dorsal scale row count of 21 at midbody in *C. mirzae*. However, some specimens we have examined from Singapore (the type locality of *C. mirzae*) have 19 dorsal scale rows, and the ratio of Singaporean specimens with 21 vs. 19 scale rows in our data set is 8:8, with both forms possessing a similar range of ventrals. In their Table 3, Amarasinghe *et al*. (2015) also list color pattern characteristics to distinguish *C. mirzae* from *C. ruffus*. A complete narrow nape band and complete narrow dorsal crossbands, however, can occur in specimens from Singapore with either 19 or 21 dorsal scale rows. These bands may also be interrupted in either 19- or 21-row specimens, and are hence not useful to distinguish among species. Furthermore, *C. ruffus* with collection localities on Java (the type locality of that species) may have 19 or 21 dorsal scale rows at midbody, and these forms are equally variable in dorsal color pattern as specimens from Singapore. While we agree with Amarasinghe *et al*. (2015) that *C. ruffus sensu stricto* is a taxon with an invariable number of middorsal scale rows, and that forms with 19 dorsal scale rows should be distinct at species level from those with 21 rows (this difference being the main character these authors used to differentiate *C. mirzae* from *C. ruffus*), the lack of a type specimen for *C. ruffus* makes it at this point uncertain whether the 19-row or the 21-row morphotype represents *C. ruffus sensu stricto*, and this hinders a diagnosis and renders their definitions of both *C. mirzae* and *C. ruffus* unsuccessful. Lastly, Amarasinghe *et al*. (2015: 38) stated that "*C. ruffus* could extend beyond Java, e.g., Borneo and Peninsular Malaysia," which would include Singapore and overlap with the distribution of *C. mirzae*, but they failed to demonstrate this zoogeographical scenario using voucher specimens. Given the problems outlined above, we see no alternative than to place *C. mirzae* in the synonymy of *C. ruffus* until it can be unequivocally defined and differentiated from that species.

Species description

Having ascertained the history of *Cylindrophis ruffus sensu historico* in general, and the history and morphology of *C. ruffus sensu lato* in particular, we are confident when we propose that a population from south-central Java with morphological features that allow unequivocal identification should be recognized taxonomically. We formally describe this species below.

Cylindrophis subocularis sp. nov.

(Figs. 3−5; Table 1)

Holotype. RMNH.RENA 8785 (Figs. 3−4; Table 1), an adult female, collected in Grabag, Purworejo Regency (formerly Koetoardjo), Central Java Province (Jawa Tengah), Java, Indonesia, by Felix Kopstein in February 1937. The original label for this specimen states "Grabag, Koetoardjo, Midden Java. +10 m."

Paratypes. All RMNH.RENA specimens were collected by Kopstein at the type locality. RMNH.RENA 8958 (Fig. 5A), a gravid female, was collected in October 1937; RMNH.RENA 8959 (Fig. 5B), an adult female, was collected in November 1937; RMNH.RENA 11257 (Fig. 5C), an adult male, was collected in August 1937; RMNH.RENA 11263 (Fig. 5D), an adult male, was collected in August 1937; RMNH.RENA 47929 (Fig. 5E), an adult male, was collected in November 1937. NMW 21559.1 (Fig. 5F), an unsexed adult specimen from Java (no precise locality provided), was also collected by Kopstein, presumably during 1937, but the date is unknown.

Referred specimen. ZMB 53459, an unsexed adult with no further collection data.

Definition. A species of the genus *Cylindrophis* that can be readily distinguished from all congeners by the following combination of characters: (1) presence of a single subocular scale, positioned between 3rd and 4th or 4th

5. A Google search for the paper by Amarasinghe *et al*. (2015) by title leads to a downloadable pdf at the URL http://fds.lib.harvard.edu/fds/deliver/51488619/nsd_014410685_corrected.pdf. This URL features the term "corrected," implying that an uncorrected version existed for download at least temporarily.

and 5th supralabial, contacting postocular and separating 4th or 5th supralabial from orbit (Fig. 4B); (2) prefrontal in very narrow contact with or separated from orbit; (3) 19 smooth dorsal scale rows at midbody; (4) 6−7 supralabials; (5) 6−7 infralabials; (6) 190−196 ventrals; (7) 6−7 subcaudals; (8) 40−48 transverse light ventral blotches, and (9) light blotches on lateral surfaces of prefrontals (Fig. 3A, 4A & B).

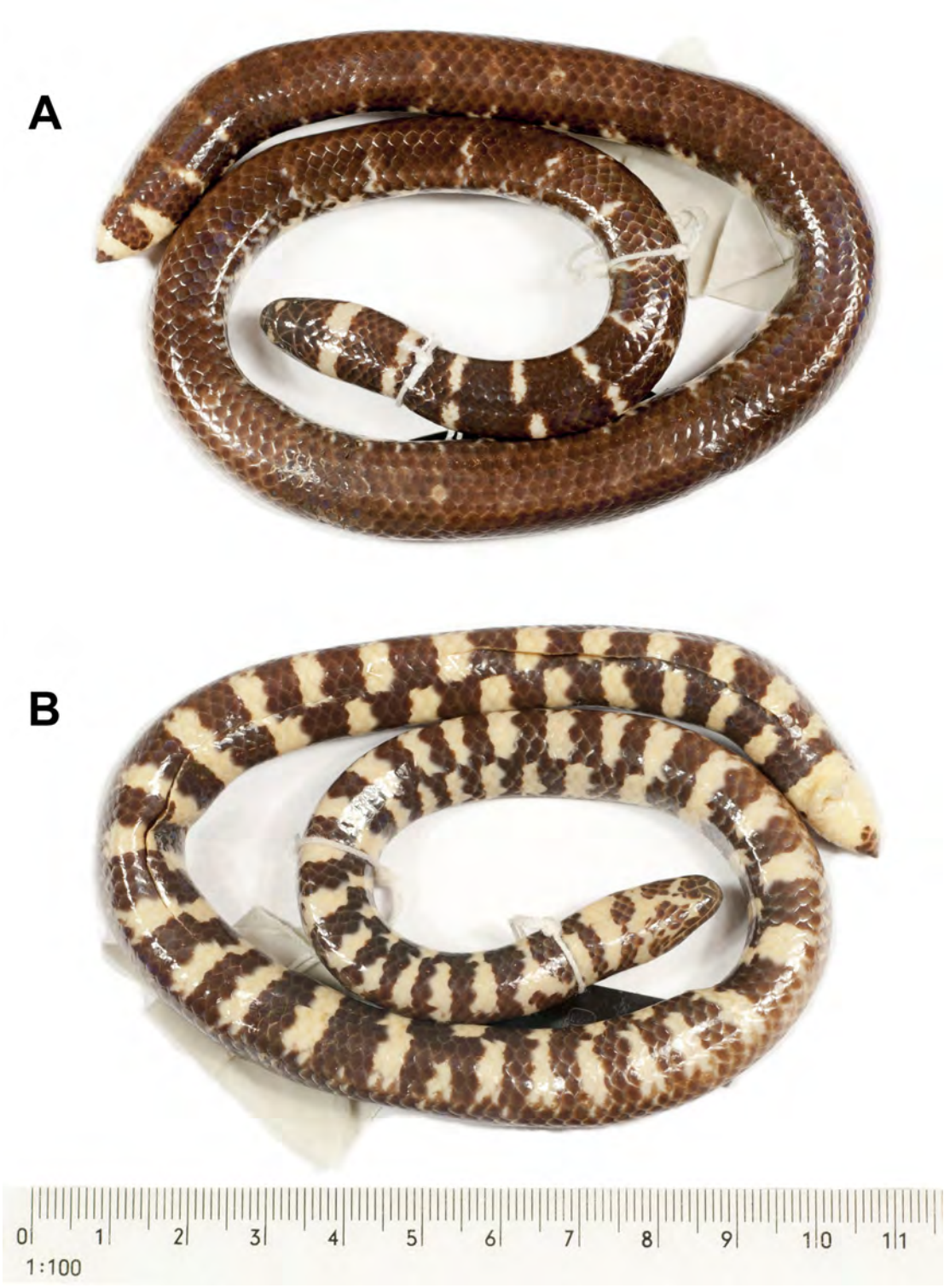

FIGURE 3. Holotype of *Cylindrophis subocularis* **sp. nov.** (RMNH.RENA 8785) in (A) dorsal and (B) ventral view. Numbered units on ruler are in centimeters. Photos by Sven Mecke.

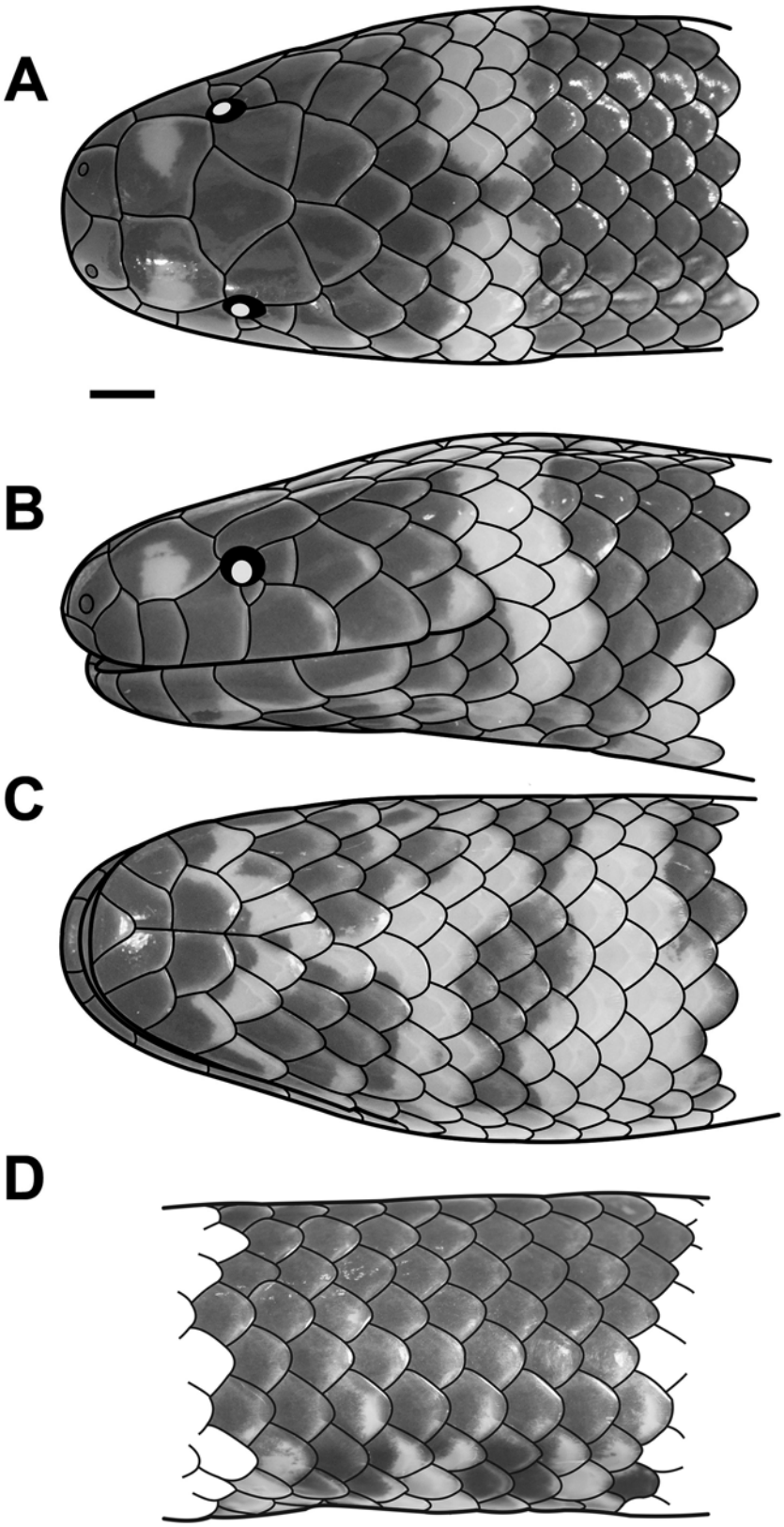

FIGURE 4. Holotype of *Cylindrophis subocularis* **sp. nov.** (RMNH.RENA 8785). (A) Dorsal, (B) lateral, and (C) ventral view of the head. (D) Lateral view of a midbody section (left side). Scale bar = 2.0 mm. Drawings by Felix Mader based on photographs by Sven Mecke.

FIGURE 5. Paratypes of *Cylindrophis subocularis* **sp. nov.** in dorsal view. (A) RMNH.RENA 8958; (B) RMNH.RENA 8959; (C) RMNH.RENA 11257; (D) RMNH.RENA 11263; (E) RMNH.RENA 47929; (F) NMW 21559.1. All RMNH specimens were collected at the type locality, Grabag, Purworejo (formerly Koetoardjo) Regency, Central Java Province (Jawa Tengah), Java, Indonesia. NMW 21559.1 is from Java, Indonesia, without detailed locality data. Numbered units on ruler are in centimeters. Photos by Sven Mecke.

Comparisons. *Cylindrophis subocularis* **sp. nov.** can be easily distinguished from all congeners by the presence of a single subocular, positioned between the 3rd and 4th (rarely between the 4th and 5th)[6] supralabial, contacting the postocular and separating the 4th (or 5th) supralabial from the orbit (e.g., Fig. 4B). In the following comparisons, ranges are followed by mean ± standard deviation and sample size (*n*), with the measures and counts for *C. subocularis* provided in parentheses. Whenever range and mean ± standard deviation are not provided, the respective character was invariable within a species.

Cylindrophis aruensis possesses 23 (19, *n* = 8) dorsal scale rows at midbody and 173–182 (190–196, 193.7 ± 2.0, *n* = 8) ventrals (Boulenger 1920; McDowell 1975; Amarasinghe *et al*. 2015). *Cylindrophis boulengeri*

6. While the general, relative position of the subocular is fixed, it may be bordered by the 4th and 5th supralabial, resulting from a vertical division of the 3rd upper labial.

possesses 197–204, 200.3 ± 3.5, *n* = 3 (190–196, 193.7 ± 2.0, *n* = 8) ventrals; and wavelike markings on supralabials, which may run onto prefrontals (uniformly dark supralabials and light blotches on prefrontals). *Cylindrophis burmanus* possesses 201−210, 208.3 ± 7.7, *n* = 6 (190–196, 193.7 ± 2.0, *n* = 8) ventrals. *Cylindrophis engkariensis* possesses 17, *n* = 1 (19, *n* = 8) dorsal scale rows at midbody; 230[7], *n* = 1 (190–196, 193.7 ± 2.0, *n* = 8) ventrals; rugose (smooth) dorsals on tail; a dorsal pattern of two paravertebral rows of spots (dorsal pattern of transverse, light, dorsolateral blotches); and uniformly colored prefrontals (light blotches on prefrontals). *Cylindrophis isolepis* possesses 21, *n* = 2 (19, *n* = 8) dorsal scale rows at midbody; and nasals separated by rostral (nasals in contact). *Cylindrophis jodiae* possesses 21, *n* = 77 (19, *n* = 8) dorsal scale rows at midbody; and wavelike markings on supralabials (uniformly dark supralabials). *Cylindrophis lineatus* possesses 21, *n* = 1 (19, *n* = 8) dorsal scale rows at midbody; 210[8], *n* = 1 (190–196, 193.7 ± 2.0, *n* = 8) ventrals; 9, *n* = 1 (6–7, 6.6 ± 0.5, *n* = 8) subcaudals; and a dorsal pattern of stripes (dorsal pattern of transverse, light, dorsolateral blotches). *Cylindrophis maculatus* does not possess light blotches on prefrontals (present); has a relatively longer snout, with SL/IOD = 1.03–1.25, 1.13 ± 0.06, *n* = 34 (0.94–1.03, 1.00 ± 0.03, *n* = 7); and a dorsal pattern of reddish-brown, large and round blotches (dorsal pattern of transverse[9], light, dorsolateral blotches). *Cylindrophis melanotus* (including its synonyms *Tortrix rufa* var. *celebica* Schlegel, 1844, *T. rufa* var. *celebensis* Gray, 1849[9], *C. celebensis* Smith, 1927, and *C. heinrichi* Ahl, 1933) possesses 230–268, 245.3 ± 10.5, *n* = 35 (190–196, 193.7 ± 2.0, *n* = 8) ventrals; and predominantly light-colored supralabials, including a characteristic dark bar running down the supralabials below eye (completely dark supralabials and light blotches on prefrontals). *Cylindrophis opisthorhodus* possesses 23, *n* = 6 (19, *n* = 8) dorsal scale rows at midbody; and has a light dorsum with dark speckles forming two paravertebral rows and occasionally a discontinuous vertebral line (dorsal pattern of transverse, light, dorsolateral blotches). *Cylindrophis ruffus sensu lato* (including its synonyms *Anguis striatus* Gmelin, 1789, *A. scytale* Russell, 1801, *C. resplendens* Wagler, 1828, and *C. mirzae*), and *C. rufa* var. *javanica* Gray, 1849 (inferred from the relevant descriptions, drawings, figures, or examination of type material) do not have a subocular scale (present). Javanese *C. ruffus sensu lato* have the prefrontal usually in broad contact with the orbit (Fig. 6; Table 1), with PrefO/ED = 0.28–0.60, 0.38 ± 0.08, *n* = 51 (prefrontal in narrow contact with or separated from the orbit [Fig. 4B]; with PrefO/ED = 0.0–0.27, 0.11 ± 0.11, *n* = 8); results of Mann-Whitney U-test: Z = 0.29, $p < 0.001^{***}$. *Cylindrophis yamdena* possesses 21 (19, *n* = 8) dorsal scale rows at midbody, and a pale light dorsum without any pattern (Smith & Sidik 1998) (dorsal pattern of transverse, light, dorsolateral blotches).

Description of the holotype: metrics (in mm) and pholidosis. An adult female; SVL 385; tail very short, TL 10 (2.6 % of SVL); head not distinct from body; body cylindrical, body diameter 12.0 (3.1 % of SVL); head rounded in dorsal view; HL 11.9 (3.1 % of SVL); HW 8.7 (73.1 % of HL); snout rounded in dorsal and lateral view; SL 5.1 (42.8 % of HL); SW 3.4 (66.7 % of SL); ED 1.3 (10.9 % of HL); pupil round; IOD 5.0 (42.0 % of HL); NOD 3.7 (31.1 % of HL); PrefO/ED 0.04; internarial distance 2.5; pelvic spurs not visible externally but hidden in pouches situated laterally of cloacal plate, covered by scales; 21/19/17 dorsal scale rows, scales smooth, apical pits absent; 196 ventrals; six subcaudals + one terminal spine; cloacal plate divided; rostral clearly visible from above, triangular, wider than high (rostral height 2.0, rostral width 2.2); two pentangular nasals, height 1.9, length 2.6; nasal suture sinistral in respect to prefrontal suture; naris positioned close to the suture of nasal with first supralabial; postnasal absent; loreal absent; prefrontal in contact with 2nd and 3rd supralabial; preocular absent; rectangular subocular scale present, length 1.0, height 0.9; one pentangular postocular (length 1.1, height 1.4); temporal formula 1 + 2, anterior temporal larger than each posterior temporal (anterior temporal length 2.5, height 2.6; upper posterior temporal length 2.6, height 2.1); 6|7 supralabials: on right side of head: 1st smallest, 3rd largest, 2nd, 4th, 5th, and 6th equal in size, 2nd and 3rd in contact with prefrontal, 3rd in contact with orbit; on the left side: 1st smallest, 3rd largest, 4th, 5th, and 6th equal in size, 2nd, 3rd and 7th equal in size, 2nd, 3rd, and 4th in contact with prefrontal, 4th in contact with orbit; six infralabials, 3rd in contact with first pair of chin shields; first pair of infralabials in contact, preventing contact of mental with first pair of chin shields; mental triangular, wider than high, width 2.2, height 1.5; two pairs of chin shields, anterior chin shield length 2.1, width 2.0, posterior chin shield length 2.6, width 1.3; mental groove present, length 3.5; one hexagonal prefrontal, length 2.9, width 3.2; one pentangular supraocular, length 2.7, width 2.6; frontal rectangular, length 3.2, width 3.8; one pentagonal parietal, length 2.9, width 2.7.

7. Stuebing (1994) reported 234 ventrals for the holotype of *C. engkariensis*. A re-examination of the specimen by one of us (HK) showed that there are only 230 ventrals present.
8. Blanford (1881) reported 215 ventrals for *C. lineatus* and Smith & Sidik (1998) provided a ventral range of 210−215.
9. *Tortrix rufa* var. *celebensis* Gray, 1849 is a *nomen emendatum* for *T. rufa* var. *celebica* Schlegel, 1844 and should currently be regarded a junior synonym of *Cylindrophis melanotus* Wagler, 1828. It is also a junior secondary homonym of *C. celebensis* Smith, 1927.

TABLE 1. Data for the individual type specimens of *Cylindrophis subocularis* **sp. nov.**, and a comparison of this species with *C. ruffus sensu lato* from Java (data of specimens with precise collection locality shown only). Metric characters are given in mm. Ranges are followed by mean ± standard deviation (indicated in parentheses). An 'X' indicates a fusion between the subocular and the postocular.

	RMNH.RENA 8785	RMNH.RENA 8958	RMNH.RENA 8959	RMNH.RENA 11257
Status	Holotype	Paratype	Paratype	Paratype
Sex	F	F	F	M
SVL	385	394	326	451
TL	10	9	10	11
Dorsals	21/19/17	21/19/18	20/19/18	21/19/17
Ventrals	196	194	192	195
Subcaudals	6	7	7	7
Supralabials	6|7	6	6	6
Infralabials	6	6	7	6
Ventral bands light	43	40	48	43
Ventral bands dark	43	40	48	43
Subocular scale length	1.0|0.8	0.8|1.0	0.6|0.9	1.6|1.8
Subocular scale height	0.9|0.6	0.6|1.1	0.6|0.9	1.7|1.9
PrefO/ED	0.04	0	0.02	0.27

TABLE 1. (continued).

	RMNH.RENA 11263	RMNH.RENA 47929	NMW 21559	*C. ruffus sensu lato* (*n* = 53)
Status	Paratype	Paratype	Paratype	
Sex	M	M	unsexed	-
SVL	331	353	288	148–737 (356.1±143.8)
TL	7	10	10	4–19 (9±3.3)
Dorsals	21/19/17	20/19/17	21/19/17	19–23/19−21/15–19
Ventrals	196	194	190	179–225 (194.5±8.9)
Subcaudals	7	7	6	5–7 (5.9±0.7)
Supralabials	6	7	6	6
Infralabials	6	6|7	6	6
Ventral bands light	40	43	45	33–59 (45.9±6.0)
Ventral bands dark	40	43	44	32–59 (45.2±5.8)
Subocular scale length	X|1.3	1.0|1.1	1.1|1.1	-
Subocular scale height	X|1.0	1.0|0.9	0.9|1.0	-
PrefO/ED	0.25	0.21	0	0.28–0.6 (0.38±0.08)

Description of the holotype: coloration and pattern in preservative (after 78 years in ethanol). Dorsal surface of head Sepia (279) with a Pale Buff (1) blotch on each prefrontal, extending from center of scale at about half scale's width to lateral edge of scale; most upper head scales with lighter edges; supralabials Sepia (279); ventral surface of head Sepia (279) with lighter edges of scales and a Pale Buff (1) 'X'-shaped marking beginning at level of lower edges of 3rd infralabial, extending to throat (Fig. 4C); neck with a two scale broad Pale Buff (1) collar, interrupted medially in vertebral region, located one dorsal scale behind parietals; dorsal surfaces of trunk and tail Burnt Umber (48); dorsal surface of trunk with paired, occasionally slightly alternating, transversely arranged Pale Buff (1) blotches, approximately one scale broad, well-developed anteriorly and posteriorly, very faint or absent at central part of trunk; dorsal surface of tail with a Pale Buff (1) band that continues to the ventral surface, demarcating a Raw Umber (48) tail tip; ventral surface of trunk Raw Umber (280), with 43 transverse, alternating ventrolateral Pale Buff (1) blotches (two ventral scales broad at midbody); cloacal region and ventral surface of tail Pale Buff (1), with a Raw Umber (280) tail tip (from 4th subcaudal to terminal caudal spine), and Raw Umber (280) blotches on scales covering the cloacal spurs.

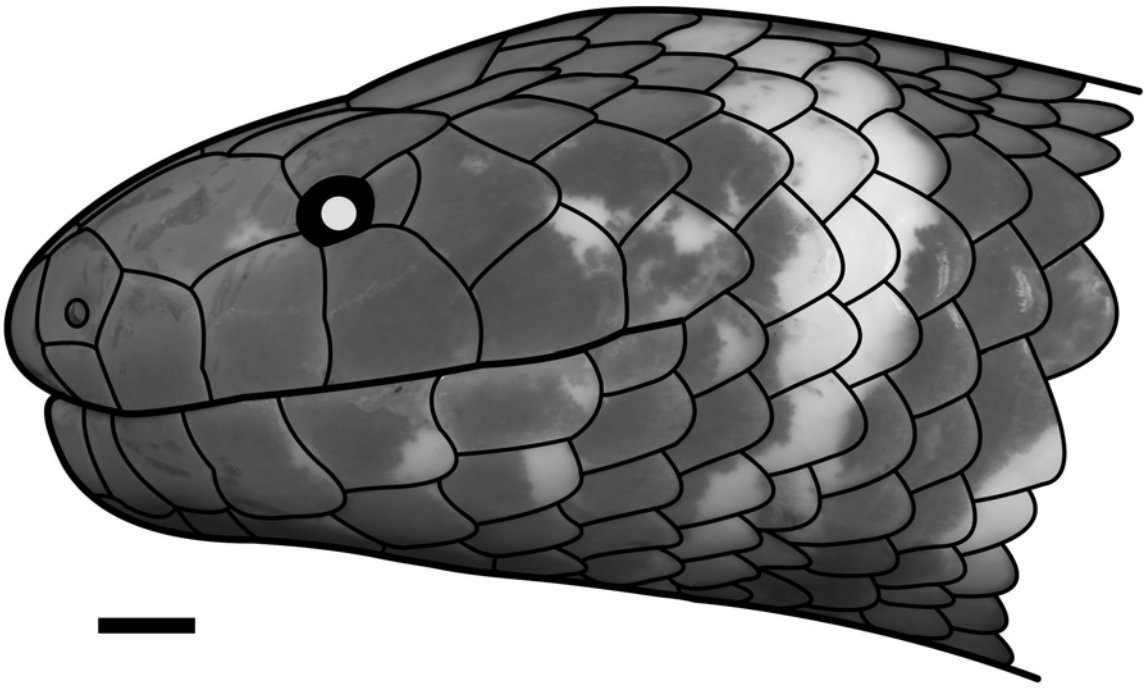

FIGURE 6. Head of a *Cylindrophis ruffus sensu lato* specimen from Bogor, Java (SMF 16980), in lateral view. Note the broad contact of the prefrontal with the orbit. Scale bar 2.0 mm. Drawing by Felix Mader based on a photograph by Gunther Köhler.

Intraspecific variation. Our assessment of the variation is based on the holotype and six paratypes (three males, three females, one unsexed specimen; Figs. 3 & 5; Table 1), with measurements provided in mm and listed including range and mean ± standard deviation and specimen numbers (*n*) in parentheses: SVL 288–451 (361.1 ± 53.7, *n* = 7); TL 7–11 (9.6 ± 1.3, *n* = 7); 21/19/17 (*n* = 5), 20/19/18 (*n* = 1), and 20/19/17 (*n* = 1) dorsal scale rows; 190−196 (193.8 ± 2.2, *n* = 7) ventrals; 6–7 (6.7 ± 0.5, *n* = 7) subcaudals; six (*n* = 5), seven (*n* = 1) or 6|7 (*n* = 1) supralabials; six (*n* = 5), seven (*n* = 1), or 6|7 (*n* = 1) infralabials; 4th supralabial in contact with orbit in specimens with seven supralabials (*n* = 2); subocular present on both sides of head in all specimens (*n* = 7); subocular may be fused with postocular (*n* = 1); subocular in contact with postocular, orbit and 3rd and 4th supralabial (in the case of the presence of six supralabials) or 4th and 5th supralabial (in the case of the presence of seven supralabials); subocular size: length on right side of head 0.6–1.6 (1.0 ± 0.3, *n* = 6) and 0.8–1.8 (1.1 ± 0.3, *n* = 7) on left side, height 0.6–1.7 (0.9 ± 0.4, *n* = 6) on right and 0.6–1.9 (1.0 ± 0.4, *n* = 7) on left side of head; 40–48 (43.1 ± 2.8, *n* = 7) alternating, light ventral blotches, two ventrals wide at midbody, three ventrals wide at midbody in a single specimen; light blotches on lateral surfaces of prefrontals might be fused into a bar running across the snout; light 'X'-shaped marking on ventral surface of head might be dissolved into a reticulated pattern.

Etymology. The specific epithet *subocularis* is a compound adjective of *sub* (Latin: 'under,' 'beneath') and *ocularis* (Latin: 'pertaining to the eye'), referring to the presence of a subocular scale in the new species.

Distribution and natural history. The new species is only known from Grabag on the south coast of Purworejo Regency, Central Java Province, Java, Indonesia (Fig. 7). The type locality in the South Central Java basin area is enclosed by mountain ranges to the north, west, and east, which include active volcanoes (Darman & Sidi 2000).

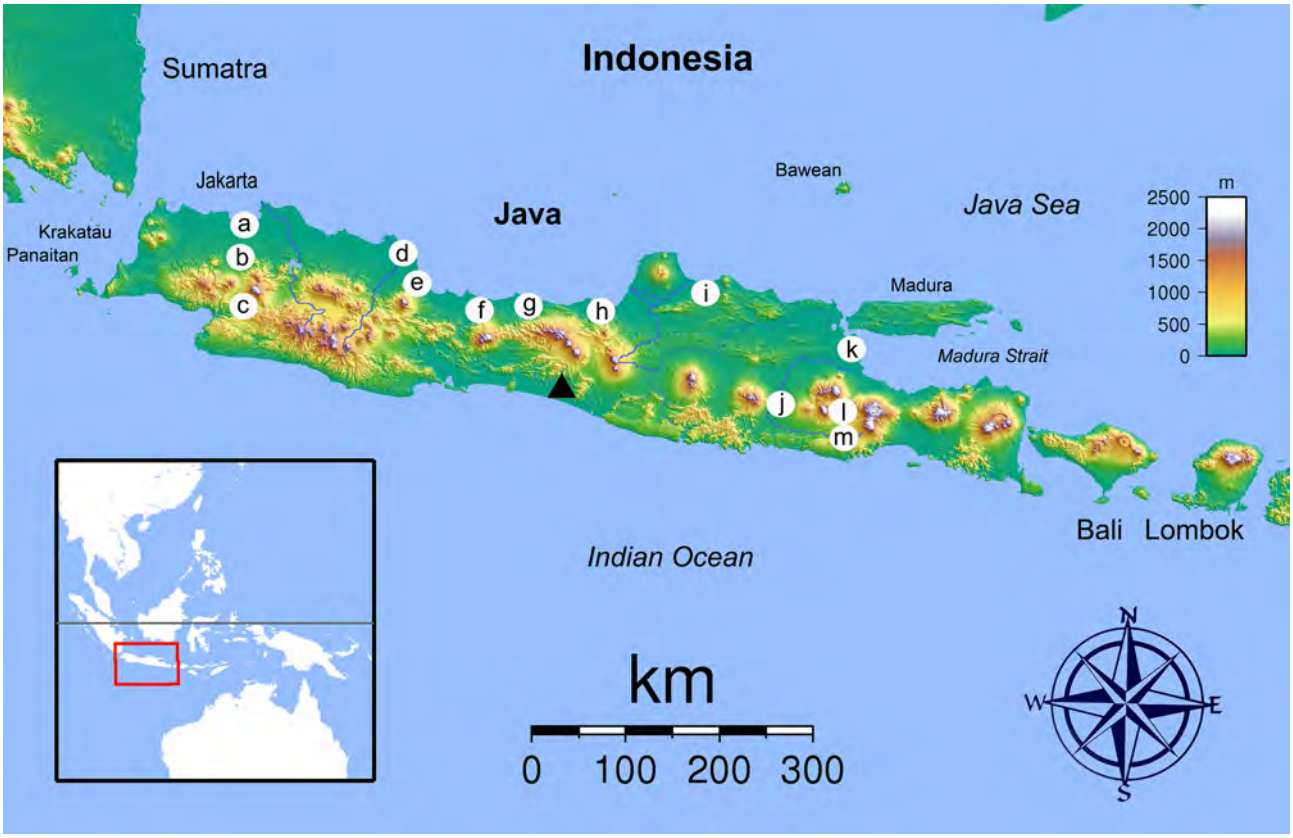

FIGURE 7. Distribution map of *Cylindrophis subocularis* **sp. nov.** and *C. ruffus sensu lato* on Java, Indonesia. The black triangle marks the type locality of *C. subocularis* **sp. nov.** at Grabag. The white circles with letters identify localities of examined specimens of *C. ruffus sensu lato*, including (a) Jakarta (Batavia), (b) Bogor (Buitenzorg), (c) Sukabumi (Soekaboemi), (d) Indramayu (Indramajoe), (e) Cirebon (Cheribon), (f) Kagok, Tegal, (g) Pekalongan, (h) Semarang (Samarang), (i) Rembang, (j) Kediri, (k) Surabaya (Surabaja, Soerabaja), (l) Mount Arjuno (Ardjoeno), (m) Malang (Malary/Malang?), and (n) Tengger Mountains. Note that not all locality data of museum vouchers provided necessarily correspond to towns and their environs but may refer to district names at the time of specimen collection. Locality names in parentheses refer to historical names provided on museum labels or in museum catalogues. Base map modified from Wikipedia © Sadalmelik / Wikimedia Commons / CC-BY-SA-3.0 by Sven Mecke.

During the geological history of Sundaland, Java was connected to the islands of Borneo and Sumatra (Voris 2000; Sathiamurthy & Voris 2006; Wilting *et al*. 2012), and according to Natus (2005) many elements of the Javanese terrestrial vertebrate fauna descended from Bornean and Sumatran lineages that migrated to Java during or even before the Pleistocene and Holocene. Natus (2005) also identified eight endemism centers for terrestrial vertebrates in Java (Natus 2005: Fig. 4.22), which can be divided into two major groups: the lowlands in the northwest (immediately adjacent to Sumatra) and the eastern parts of Java, and the highlands of the Neogene-Quaternary volcanic arc that stretches longitudinally through the centre of Java. The South Central Java basin, however, has long been isolated to the north by the central volcanic chain (based on the maps presented in Sathiamurthy & Voris 2006) that may have largely prevented immigration events to the south, leading to vicariant evolution. Although the range of *Cylindrophis subocularis* is probably not restricted to Grabag, it may indeed exhibit a relatively limited distribution in the South Central Java basin and therefore should be regarded as a regional endemic.

Based on the lifestyle of congeneric species, we assume that *Cylindrophis subocularis* is semifossorial and preys mainly on elongate vertebrates (e.g., fishes, caecilians, skinks, and snakes: Schmidt 1928; Taylor 1965; Pauwels *et al*. 2000; Kupfer *et al*. 2003; pers. obs.), which are subdued by constriction (Greene 1983). Both the limited distribution and the secretive semifossorial lifestyle of *C. subocularis* may explain its apparent rarity in museum collections.

One specimen of the new species (RMNH.RENA 8958) contains eggs covered by a thin membrane. An incision into the membrane of one of the largest eggs (length 26.8 mm, width 13.3 mm) revealed the presence of an

embryo (approximately at developmental stage 26−27, following Zehr 1962). We believe that this observation confirms that *Cylindrophis subocularis* is a viviparous species (*sensu* Blackburn 1994), with viviparity being the reproductive strategy for most, if not all, *Cylindrophis* species (de Rooij 1917; Smith 1943; McDowell 1975; Blackburn 1985; Brischoux *et al*. 2011). We also found one specimen of the closely related *C*. *ruffus* from Java (NMW 21558.6) that contains fully developed embryos. No further information is available on the biology of *C*. *subocularis*.

Remarks. While we discovered six of the seven type specimens of *Cylindrophis subocularis* in the collection of the RMNH, all of which were collected by Felix Kopstein (1893−1939) and accompanied by precise collection locality data, a single specimen was found in the collection of the NMW. For this specimen (NMW 21559.1) the collection locality is limited to "Java," but the specimen label lists Felix Kopstein as the collector of the specimen. Based on specimen labels in the RMNH, Kopstein collected *Cylindrophis* specimens at other localities in Java, such as at "Indramajoe" (Indramayu, on the north coast of Central Java). We have examined these, as well as 113 additional Javanese specimens, and all lack a subocular scale and have the prefrontal usually in broad contact with the orbit. We believe that NMW 21559.1 is part of the series Kopstein collected on the south coast of Central Java, but deposited mostly in Leiden, with the single specimen deposited in the Vienna collection[10]. We discovered an additional specimen of *C*. *subocularis* in the Berlin collection (ZMB 53459). In the absence of a listed collection locality and collector's name, we chose not to include this specimen in our type series.

Two specimens (RMNH.RENA 47931–32, formerly RMNH.RENA 8785.80–81) from the same original jar (jar number 8785) as the holotype (RMNH.RENA 8785, formerly RMNH.RENA 8785.51) and supposedly also collected at Grabag, are not conspecific with *Cylindrophis subocularis*. In the original catalogue of the herpetological section of the RMNH, we found the following entry:

> "*De fles [8785] bevat nu 3 ex, zij zijn bewerkt door E.M.J. Jaspars en door hem voorzien van de nrs. 51, 80, 81. Mogelijk zijn de nrs 80 en 81 door bewerker bij vergissing in deze fles ondergebracht en zijn zij afkomstig van Buitenzorg [Bogor], Java.*"
>
> [The jar [8785] now contains three specimens; they were examined by E.M.J. Jaspars and labeled with the numbers 51, 80, 81. Potentially, the numbers 80 and 81 have been misplaced in the jar by the researcher and they may have originated in Buitenzorg [Bogor], Java.]

We agree with the catalogue entry that RMNH.RENA 47931–32 (formerly RMNH.RENA 8785.80–81) were most likely misplaced in the jar; these specimens strongly resemble *Cylindrophis ruffus* from Bogor (n = 9) in having no subocular and the prefrontal in broad contact with the orbit, PrefO/ED = 0.42 and 0.47 respectively (vs. subocular present and prefrontal in narrow contact with or separated from the orbit in *C*. *subocularis*, PrefO/ED = 0.0–0.27, 0.11 ± 0.11, n = 8). An additional specimen (RMNH.RENA 11255), with greatly damaged anterior head scalation, but lacking a subocular scale, was supposedly also collected at the type locality of *C*. *subocularis*. Due to the consistent presence of a subocular scale in the Grabag population, we have reasonable grounds to believe that RMNH.RENA 11255 is also not conspecific with the new species. We believe that RMNH.RENA 11255 was most likely also misplaced or erroneously labeled, as was the case with RMNH.RENA 47931–32.

Discussion and outlook

Species of *Cylindrophis* have generally been described from small series of specimens collected at remote localities (e.g., Roux 1911; Boulenger 1920; Stuebing 1994; Smith & Sidik 1998) or, especially in the early days of taxonomy, were described using insufficient or unsuitable characters (e.g., Laurenti 1768; Wagler 1828–1833). Taking into account the distribution of the morphologically variable taxon *Cylindrophis ruffus sensu lato* (Java, Borneo, Sumatra, Singapore and Peninsular Malaysia), which heretofore had been considered even more widely

10. It is perhaps incongruous that an Austrian naturalist with ties to the NMW would not deposit a majority of specimens at what was essentially his home institution (without formal ties). It is possible that Kopstein had designs on an appointment at the RMNH, and he perhaps sent a significant number of specimens there to court favor. Unfortunately for Kopstein, he died before his appointment might have become reality (Marinus Hoogmoed, in litt.).

distributed, it appears that the diversity of *Cylindrophis* in general, and of forms hidden under the name *C. ruffus* in particular, is still significantly underestimated. While *C. ruffus* has long been identified as a species complex in need of a thorough and comprehensive revision, including the designation of a neotype (Mecke *et al*., in prep.), we feel it necessary to caution against taxonomic studies of such historically difficult taxa without a solid basis of comparative material, without a wide range of characteristics used, and when personally unfamiliar with relevant specimens. While a general aim of these studies is to achieve greater taxonomic stability, the example of *C. mirzae* shows that, even with the best intentions, a small data set may yield an unsatisfactory result.

Cylindrophis subocularis is superficially similar to other forms currently referred to as *C. ruffus sensu lato*. It is, however, 'inconspicuously conspicuous,' because it is easily diagnosed by its unique pholidotic characters: the presence of a subocular and the prefrontal in narrow contact with or separated from the orbit. The former character has been considered of broad taxonomic importance in snake systematics and has readily been used to identify distinct species (e.g., Schätti 1987; Dowling & Price 1988[11]; O'Shea 1998, 1999; Murphy *et al*. 2005). We are confident that the subocular scale in *C. subocularis* represents a true, distinctly differentiated scale and not an aberrant horizontal division of the 4th or 5th supralabial (in specimens with six or seven supralabials respectively). In contrast to developmental aberrations in head scales, which usually occur only on one side of the head, the subocular occurs bilaterally in all specimens in precisely the same position below the orbit. This convincingly demonstrates that the occurrence of a subocular scale in the genus *Cylindrophis* is a stable character found only in a single, probably isolated population and does not represent a sporadic aberration found across the genus. Moreover, the scale is always of the same rectangular shape and is clearly independent of the supralabial below it. In one specimen (RMNH.RENA 11263), the subocular is fused with the postocular on the right side of the head, but still clearly separated from the supralabial, which supports the concept of this scale as an independent, bilaterally occurring pholidotic character. During our examination of *Cylindrophis* specimens from the entire range of the genus (451 specimens), we found ten specimens (2.2 %) with aberrant head scale conditions, of which seven (70 %) were unilateral anomalies of bilaterally occurring scales and three (30 %) were aberrant divisions or fusions of azygous head scales. Unilateral anomalies of bilaterally occurring scales included deformations and were never found to occur in a single population with any specific frequency.

Cylindrophis subocularis is one of several poorly known species with a rather restricted area of distribution, and in that it is similar to *C. aruensis*, *C. boulengeri*, *C. engkariensis*, *C. isolepis*, and *C. yamdena*. As outlined above, the new species is only known from eight specimens collected almost 80 years ago, six of which were evidently collected at a single locality in southern Java. Although it appears to be generally accepted that the Javanese herpetofauna is relatively well studied compared to the herpetofaunas of the other Greater Sunda Islands (e.g., Teynié *et al*. 2010), we argue that historic and recent research has mostly been conducted along the north coast and the western and eastern parts of the island. Hence, species diversity for the whole of Java may still be underestimated. The recent discovery of new bent-toed gecko species (genus *Cyrtodactylus*) in Java (Riyanto *et al*. 2014, 2015; Hartmann & Mecke *et al*., 2016) indicates that new species, some of which have a rather limited area of distribution, are still being identified.

It is uncertain at this time whether *Cylindrophis subocularis* exhibits a wider distribution than the single collection locality would indicate, or is truly a localized endemic. Herpetological surveys of southern coastal localities in Java are required to investigate the taxon's distribution and population size, and to assess any potential threats that may impact its conservation status. It may be noted that Central Java has little remaining forest, and that the long history of deforestation and intensification of agriculture along the south-central coast potentially led to local species extinctions in the region (Whitten *et al*. 1996). As the almost 80-year-old type series of *C. subocularis* is unsuitable to obtain molecular data, it would be desirable to obtain fresh tissue samples for molecular genetic approaches to investigate its phylogenetic affinities, especially in relation to *C. ruffus sensu lato*.

During our work with specimens of *Cylindrophis*, we have progressively been able to recognize morphological and ontological patterns in these snakes that would not be recognizable when working with only a few selected specimens, let alone only type specimens. Detailed revisions of the *C. ruffus* and the *C. melanotus* complexes, including the description of new species, are ongoing and will be published elsewhere (Kieckbusch *et al*. & Mecke *et al*., in prep.).

11. Dowling & Price (1988) called suboculars "lorilabial scales."

Acknowledgments

For the loans of specimens and for access to collections under their care during our visits, we are very grateful to Esther Dondorp (RMNH); Georg Gassner, Silke Schweiger, and Heinz Grillitsch (NMW); and Frank Tillack and Mark-Oliver Rödel (ZMB). Further important material for comparison was provided by Lauren Vonnahme, David A. Dickey, David A. Kizirian, and Christopher J. Raxworthy (AMNH); Andreas Schmitz (MHNG); Markus Auer and Raffael Ernst (MTKD); Stefan T. Hertwig (NHM); Urs Wüest and Denis Vallan (NMB); Linda Acker and Gunther Köhler (SMF); Jakob Hallermann (ZMH); and Kelvin Lim (ZRC). We are very grateful to Harry W. Greene (Cornell University, Ithaca, USA), John C. Murphy (FMHN), Marinus S. Hoogmoed (MPEG), Roy W. McDiarmid (USNM), George R. Zug (USNM), Frank Tillack, Gernot Vogel, and an anonymous reviewer for their helpful comments on earlier versions of the manuscript. SM thanks Glenn Shea (AM) for fruitful discussions regarding scale characteristics and pholidotic aberrations. We thank Britta Döring (Philipps-Universität Marburg, Germany) for contributing to data collection. Many thanks to Felix Mader who prepared the drawings in Figs. 4 & 6, and to Gunther Köhler who provided the photograph on which the illustration in Fig. 6 is based. We further thank Linda Acker, Aaron M. Bauer (Villanova University, Villanova, USA), Esther Dondorp, Georg Gassner, Heinz Grillitsch, Gunther Köhler, Silke Schweiger, and Frank Tillack for providing some of the literature cited below. This study was supported by an AMNH collection study grant to SM. This paper is contribution No. 19 from the Tropical Research Initiative at Victor Valley College.

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APPENDIX. Specimens examined for comparison.

Cylindrophis burmanus.—**Myanmar**: *Kachin State*: Bhamo: NMB-REPT 479, NMW 21552.3–4, ZMB 11619, ZMH R06256; *Rakhine State*: "Aracan": MTKD 14867.

Cylindrophis boulengeri.—**Indonesia**: *Maluku Province*: Wetar Island: without precise locality data: RMNH.RENA 5529A.168, 5529B.169; Ilwaki: Wetar Island, SMF 16996 (holotype).

Cylindrophis engkariensis.—**Malaysia**: *Sarawak* (*Borneo*): Second Division, Lubok Antu District, Lanjak-Entimau, headwaters of the Engkari River, Nanga Segerak: ZRC 2.3398 (holotype).

Cylindrophis isolepis.—**Indonesia**: *South Sulawesi Province*: Jampea Island: RMNH.RENA 11269A.171, 11269B.72.

Cylindrophis jodiae.—**Malaysia**: *Kedah State*: NMW 39624.2; Penang: NMW 21570.1, 21570.4. **Thailand**: no precise locality data: NMW 21556.4, ZMH R09798–99, R09801–02, MTKD 24126–27, SMF 16987, 16991, ZMB 30205, 52611; *Bangkok Province*: Bangkok: MHNG 1335.17, NMW 21561, 21562.1−4, 21563.1−2, 21564.1−11, SMF 58675, 58679, 61903, 64838, ZMB 4394, 4545, 58428, ZMH R09794, ZRC 2.4583; *Chiang Mai Province*: MTKD 39216; Dangrek Mountains: Phu Khi (Pu-Kin, Don-Rek): NMW 21556.2, 21569.1−3; Don Pia Fei Mountains: NMW 21565.1−6, 21566.1−6; Muang Pou Vieng (Pu Wieng): NMW 21567.1−2; *Phang Nga Province*: Khaolak-Luk National Park: ZMB 55188; *Phetchaburi Province*: Puek Tian: NMW 21569.1–3; *Saraburi Province*: Saraburi: MHNG 1471.30, MHNG 1530.9. **Vietnam**: no precise locality data: NMBE 1015768−69; *Ho-Chi-Minh Province*: Ho-Chi-Minh City: NMBE 1015764–66, ZMB 31123, 50774; "South Vietnam": MHNG 1325.30, 1551.18–20.

Cylindrophis lineatus.—**Singapore** (in error): AMNH R-12872.

Cylindrophis maculatus.—**Sri Lanka** (occasionally labeled as "Ceylon"): without specific localities: MHNG 762.65, 1199.44, 2745.34, MTKD D14873–76, NMW 21574.1–5, NMW 21575.1–2, RMNH.RENA 160–63, SMF 16995, ZMB 1456, 18550, 18551.A–B, 24125, 49460, 77698, ZMH R09785, R09792, R09795–96. *Central Province*, Kandy District, Peradenyia: ZMB 31506. *Sabaragamuwa Province*: Kitulgala: MHNG 2156.29; Ratnapura: MHNG 2156.30. *Western Province*: near Colombo: MHNG 1199.30–32.

Cylindrophis melanotus.—**Indonesia:** *North Maluku Province*: Bacan Island: SMF 16975; Halmahera: ZMB 34313 (holotype of *Cylindrophis heinrichi* Ahl, 1933)); Sanana Island (Soela-Sanana): RMNH.RENA 5104.176. *Central Sulawesi Province*: Poso: ZMA.RENA 11453.117–19; Lake Wawontoa: ZMB 62929. *South Sulawesi Province*: Lake Tempe: ZMA.RENA 11464.116; Makale: RMNH.RENA 11274.88; "Patmmang" (possibly Ujung Pandang, today's Makassar): NMW 21571.1–3. *North Sulawesi Province*: Lake Moat: ZMB 50020; Manado: RMNH.RENA 19.82, 173.18B, 174.18A, 5459.41–42; without precise locality data: RMNH.RENA 5461.34–40, ZMA.RENA 11451.112–15. *Southeast Sulawesi Province*: Buton Island, Bau Bau: RMNH.RENA 11265.87; Kolaka: RMNH.RENA 11276.89. Mainland Sulawesi (occasionally labeled as "Celebes"): without precise locality data: RMNH.RENA 17.83–84, 17.86, ZMA.RENA 11459.120, ZMB 1450, 4049 (potential holotype of *Tortrix rufa* var. *celebica* Schlegel, 1844).

Cylindrophis opisthorhodus.—**Indonesia**: *East Nusa Tenggara Province*: Flores Island: SMF 23301, ZMB 33787. *West Nusa Tenggara Province*: Lombok Island: SMF 23299, ZMA.RENA 12135, 14082; Sumbawa Island: SMF 23300.

Cylindrophis ruffus sensu lato.—Indonesia: without precise locality data: ZMH R09749, R09786, R09793, R09797. "East coast of Borneo": RMNH.RENA 3924.15–17. "Java": MHNG 2745.35–38, MTKD D5614–15, D7071, D14868–72, NMW 13835–36, 21558.1, 21558.3, 21558.6, 21558.8, 21559.2–14, NMBE 1015767, RMNH.RENA 1.65–68, 46, 47927–28, SMF 16976–78, 16981–82, 16984–86, 16990, ZMA.RENA 10495, 11452.145, 11467.151–53, 14460, ZMB 1455, 4908, 13129, 29696. "South Java": ZMB 14443, 58433. "Sumatra": NMW 21550.4–5. *Aceh Province* (Atje), Sumatra: NMW 21550.2. *Bangka-Belitung Islands Province*: Bangka Island: ZMA.RENA 10487, 23068, 23070; Belitung Island: ZMA.RENA 11471.177–79. *Central Java Province*: Kagok, Tegal: ZMA.RENA 11455.155; Pekalongan: ZMA.RENA 11468.157; Rembang: RMNH.RENA 11252.105; Semarang (Samarang): RMNH.RENA 5.60–61, ZMA.RENA 11461.158, ZMB 14351, 58429–30. *Central Kalimantan Province* (Borneo): Muara Teweh: NMW 21554.6. *East Java Province*: without precise locality data: RMNH.RENA6928.52–55; Kediri: ZMA.RENA 11462.159, 11454.146–50; Malang (Malary): NMW 21558.4–5; Mount Arjuno (Ardjoeno): RMNH.RENA 11260.108–09, 11261.93–94; Surabaya (Surabaja, Soerabaja): RMNH.RENA 5791.49, 5999.58–59, 11251, 11252.105, ZMA.RENA 11457.154; Tengger Mountains: NMB-REPT 471–73. *Jakarta Province* (Java): Jakarta (historically: Batavia): MTKD D14750, NMB-REPT 20441. *North Sumatra Province*: Langkat: RMNH.RENA 6349.25–26; Tanah Merah, Bindjey Estate: ZMH R09751–52. *Riau Province* (Sumatra): Rantau Island: RMNH.RENA 8185.13; Sungai Lala: ZMH R09787. *South Sumatra Province*: Tanjung Enim: ZMA.RENA 11458.126. *Sultanate of Deli* (Sumatra): NMW 21550.1, 21550.3, 21568.1–6, RMNH.RENA 6968.27–33, ZMA.RENA 10490, 11463.125, 11465.127, 11466.124. *Sultanate of Serdang* (Sumatra): ZMA.RENA 11460.123. *West Java Province*: Bogor (historically: Buitenzorg): NMB-REPT 462–70, RMNH.RENA 11256.110, 11258.92, 11272.98, SMF 16979–80, 16992–94, ZMB 20525; Cirebon (Cheribon): ZMA.RENA 11469.129–33; Indramayu (Indramajoe): RMNH.RENA 8956.56, 8972.62–64; Itjabe: MHNG 676.67; Sukabumi (Soekaboemi): ZMA.RENA 11456.156. *West Kalimantan Province* (Borneo): Badau: NMW 21554.5; Landak: ZMA.RENA 10488, 23064; Pontianak: RMNH.RENA 8234.2–3, 8264.5–6, 8264.8–11, 8264.14. Malaysia: *Johor State*: no precise locality data: AMNH R-12873; Johor Bahru: ZRC 2.3009–10. *Kelantan State*: Kuala Lebir: ZRC 2.3011. *Penang State*: no precise locality data: NMW 21570.2–3; *Sarawak* (*Borneo*): Baram: NMW 21554.1; Sungai Tangap, Niah: AMNH R-111923. Singapore: no precise locality data: ZMH R09788–89, ZRC 2.3017–20, ZRC 2.3021, ZRC 2.3023, ZRC 2.6907; Bukit Timah Road: ZRC 2.3022; Sembawang: Naval Base: ZRC 2.3029.